

SOME ASPECTS OF DISCOURSE STRUCTURE AND  
COHESION IN SELECTED SCIENCE LECTURES

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## SYNOPSIS

Insofar as lectures are conducted mostly in the form of a monologue, they are seen as constituting a special form of speech event, which poses particular problems in identifying their larger scale principles of linguistic organisation. The role of various cohesive devices in unifying the unfolding text is examined, but it is argued that this needs to be complemented with some notion of discourse structure. A model of discourse structure is proposed which contains, fundamentally, three layers: Member, Period and Episode. Episodes are the largest discourse unit proposed and these are distinguished by focusing activity at their boundaries; very loosely they represent divisions into 'topics'. Episodes are segmented into Periods which are considered to have a definable prosodic shape specified in terms of Key (relative pitch height) and Tone (pitch movement). Periods themselves are constituted by Members which - though seen as coterminous with the largest unit of grammar - can simultaneously be ranged into classes according to their function in the discourse. Such functions are seen as primarily related to the presentation and structuring of the information, or to the reception of the discourse by the audience. Constituency relationships between units on different layers of the discourse scale are left ill-defined, but it is argued that the model proposed thereby remains more flexible and is thus better able to demonstrate the process whereby the discourse reflects back on itself in the light of the lecturer's moment by moment assessment of the felicity of his utterance. In this respect it is claimed that although monologue discourse is delivered by one person, it is nonetheless shaped by the exigencies of interaction.

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## CONTENTS

### CHAPTER ONE

#### Lectures: a short review of the literature

Introduction	1
I Function and purpose	2
II Structure and organisation	9
(A) The pedagogic viewpoint	9
(B) The discourse analysis viewpoint	17
(C) Audience receptivity	23
III Evaluation	31
Conclusion	33

### CHAPTER TWO

#### Supra-syntactical organisation in lecture monologue

1. Preliminary remarks: interaction and structure in lecture monologue	35
2. Cohesion or discourse?	43
2.1. The problem of sentence	49
3. Cohesion	53
3.1. Cohesion: reference	54
3.1.1. Personal reference	55
3.1.2. Demonstrative reference	57
3.2. Cohesion: substitution	62
3.3. Cohesion: conjunction	65
3.3.1. Additive	65
3.3.2. Adversative	76
3.3.3. Causal	80
3.3.4. Temporal	84
3.4. Structural parallelism and lexical repetition	86
4. Cohesion and discourse	88

### CHAPTER THREE

#### Lecture discourse: function and plane

1. Introduction	95
1.1. A note on function	95
1.2. A note on plane	96
2. Lecture discourse	99
2.1. Subsidiary discourse	100
2.1.1. Glossing	100
2.1.2. Asides	105
2.2. Main discourse	111
2.2.1. Focusing: prospective	112
2.2.2. A note on markers	115
2.2.3. Retrospective focus: conclusion	117
2.2.4. Informing	119
2.2.5. Recall members	122
3. A note on structure	124

## CHAPTER FOUR

### Discourse and Intonation

1.	Introduction	128
2.	Intonation and discourse	128
3.	Key and discourse: definitions	133
3.1.	Key	133
3.2.	Tonic segment	134
3.3.	Termination choices	135
3.4.	Notation	136
3.5.	Textual abbreviations	137
4.	Communicative values of key and termination choices	137
4.1.	Structural values of high key	138
4.2.	'Semantic' or 'internal' values of high key	143
4.3.	Communicative values of low key	145
5.	Tone and discourse	149
5.1.	The referring v. proclaiming distinction	149
5.2.	Tone: sequencing	155
6.	Tonicity (and lexical cohesion)	158
7.	Tonicity and discourse	163
8.	Further prosodic features of subsidiary discourse	167
9.	The structure of periods	170

## CHAPTER FIVE

### Conclusion

1.	Discussion of the discourse model	179
2.	Some pedagogic implications	185
3.	Monologue and discourse analysis	187

## APPENDIX ONE: the transcripts

### Lecture one:

Mathematical Physics for first year Electrical Engineering students

### Lecture two:

Amplifiers and Circuit Design for first year Electrical Engineering students

### Lecture three:

Introductory Botany for second year students of Biological Sciences

CHAPTER ONE

LECTURES: A SHORT REVIEW  
OF THE LITERATURE

## INTRODUCTION

Despite many misgivings over its use as a teaching method, especially in the last ten years, 'the lecture remains in most subjects the main vehicle for instruction'<sup>1</sup>. This tension between declared opinion and actual practice has generated an extensive literature on various educational aspects of the lecture method. Some of the areas of concern that emerge in the literature may be summarised as follows: comparisons of the lecture with other methods; suggestions about how lectures might be made more effective; studies of the psychological 'set' of lecture audiences; and evaluations of lectures, usually by considering the reactions of audiences. Throughout this literature, however, we find very little examination of the actual lecturing process itself, nor has much attention been paid to the way this process is reflected and constituted in speech.

At the same time the lecture itself has undergone something of a transformation, not only as a result of uneasiness at its effectiveness, but also because of the influx of new educational technology such as overhead projectors, video and audio tape-recorders, slide projectors etc. The combination of these two factors has led to the development of hybrid forms. Donald Bligh (1972), for instance, lists seven teaching methods ranging from 'buzz groups' to audiotapes and reading which can profitably be used within the overall context of a lecture and there are many possible combinations of these methods. In this climate of change there is thus more of a case than ever for a close examination of the role of speech in lectures.

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<sup>1</sup> The Hale Report: p.52

Unfortunately, most accounts of research into lectures do not even specify in detail what constitutes a lecture for the purposes of the particular investigation. In this account we will use the term to denote situations involving a single teacher teaching a group of students usually numbering twenty or more, mainly or exclusively by verbal expositions.

We shall consider the function and purposes of lectures from the point of view of both lecturers and students and which of these functions may be considered appropriate in the light of research. We shall review recommendations concerning the organisation and structuring of lectures and attempt a comparison with one study of an actual lecture. We shall draw on investigations of psychological constraints on learning processes to make further remarks about the structure of lectures and shall conclude with some remarks on their evaluation.

## I FUNCTION AND PURPOSE

A useful picture of how lecturers consider the role of lectures is presented in the Hale report on University Teaching Methods (U.G.C. 1964). This reveals that many lecturers consider students too immature to study independently.

Teachers of science therefore consider that lectures provide a useful method of opening up difficult topics which students cannot undertake unaided and that, where subject matter is quickly outmoded, lecturing is the most "economical method" of making new topics available. They claim also that in lecturing they can respond to students in a way that teaching aids cannot do, that they are able

to build up a complex argument or diagram, make reference to recent developments and indicate topics for further inquiry. Through his personal presence the lecturer can also share his enthusiasm for the subject with his students.

It seems clear however that not all these statements of intent can be accepted uncritically. Although lecturers may be more responsive than teaching aids (e.g. programmed learning or CCTV) other teaching situations such as the seminar or the tutorial may be even more responsive. Arguments about the economy of lectures in terms of employment of staff resources do not usually take into account the quality of learning that takes place. Are lectures really more "economical", if the quality of learning associated with them is substantially poorer than that associated with other teaching methods? One may further question the basic premiss that students are too immature to study independently. If students are too immature to study independently, do lectures really help them to develop a more self-regulating and self-directing approach to learning or do they merely reinforce or perhaps produce the very lack of maturity that is bemoaned?

Students themselves have a slightly different and more modest view of the role of lectures. In the N.U.S. report of 1969 (Sanders et al) students thought the major functions of lectures were to impart information (76 per cent), to provide a framework for the course (75 per cent), to indicate methods of approaching the subject (64 per cent), to indicate sources of reference (47 per cent), and to stimulate independent work (41 per cent). Presumably 59 per cent did not think that lectures stimulated independent work and very few

students seem to have found in lectures a source of inspiration or enthusiasm for their subject.

From these two complementary studies we may compile a list of possible objectives for lectures. This list corresponds with that offered by Gregory (1975). Possible functions of lectures are:

- (1) to provide a framework for private studies and guidance as to sources, when the lecture supplies the basic teaching;
- (2) to furnish information and view points that are not readily available, or not available in an appropriate form, e.g. data from the lecturer's own research;
- (3) to stimulate thinking;
- (4) to arouse enthusiasm;
- (5) to encourage a critical attitude;
- (6) to provide an appropriate model of such qualities and attitudes as precision and clarity of thought and expression.

Bligh (1972) clusters these aims under three broad headings:

- (i) the communication of information;
- (ii) the transmission of cognitive skills, e.g. the logical presentation of an argument;
- (iii) the alteration of attitudes.

Educational research however, reveals that not all these objectives are best served by lectures. Bligh conducted a survey of 91 studies comparing lectures with other teaching methods and concluded that lectures do convey information and that they are at least as effective as other teaching methods in this respect. "The Lecture", he maintains is one method of achieving the first kind of objective (i.e. the transference of information) and its use for this purpose is at least sometimes justifiable. But he continues, "since the other methods are equally effective, this conclusion does not necessarily justify the frequent heavy reliance on the lecture method in tertiary education".<sup>1</sup>

The case for lectures as a vehicle for promoting thought is more difficult to establish. It is difficult, for example, to construct studies that are both able to measure or demonstrate the presence of thought processes in a set of subjects and relate them specifically to the use of a particular teaching method. Though the relations between thought processes and teaching methods are difficult to establish, Bloom, for instance has investigated the kinds of mental activity undertaken by students in two different situations - the lecture and the discussion. He asked students, while listening to tape-recordings of lectures or discussions which they had previously attended, to recall at intervals their thoughts in the original situation. A partial breakdown of their responses is given below:

Time spent in:	Lectures	Discussions
1. Irrelevant thoughts	31 per cent	14.5 per cent

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1 Bligh: What's the Use of Lectures? (1972) p.31

2 Bloom, B.S. (1953)



2. Problem solving and synthesising information	1 per cent	8.3 per cent
3. 'Passive thoughts about subject and thoughts evidencing simple com- prehension'	36.8 per cent	20.3 per cent

These figures suggest that students are more actively involved, attentive and thoughtful during discussions than they are in lectures. The common sense explanation of this phenomenon is that the two situations demand different roles of students. In the lecture the student is not usually called on to contribute to the discourse. This role is limited to a relatively passive one of interpreting, selecting and noting down what he hears and sees. By comparison his role in a discussion is potentially much more active. He can contribute to the shaping and development of the discourse.

If we accept Bloom's findings and a common sense interpretation of them, it follows that lectures are not the best vehicle for promoting thought.

If promotion of thought is desired then the best method for doing so would seem to be one that demands an active rather than a passive role. Seminars are doubtless more demanding in this respect than lectures.

Considering the third possible objective of lectures, the alteration of attitudes, we find that some of the arguments applying to the previous objective still apply. More participatory learning situations seem better suited for engagement with questions of value and attitude.

This conclusion is borne out by Lewis's experiment in which he gave exactly the same information to two groups of housewives, one in a lecture situation and the other in a discussion group. The content referred to the desirability of eating whale meat. When questioned sometime later, 31 per cent of the discussion group had actually served whale meat as opposed to only 3 per cent of the lecture group.

This suggests that while lectures may reinforce existing attitudes, discussion is a more appropriate method for changing them.

The notion that lectures may promote enthusiasm for a subject is not borne out by students' attitudes to lectures in general. McLeish undertook a study aimed at rating teaching methods in 10 colleges of education and several universities. There was a marked preference for seminars and tutorials and a relative distaste for lectures in all groups of students, which would be difficult to account for, if they were generally promoting enthusiasm and interest. If lectures do inspire students it seems inconsistent that if anything they desire less of them.

We may conclude that though lectures are as effective as other teaching methods for transmitting information they are not as effective as other teaching methods for promoting thought or changing attitudes.

Nonetheless, certain reservations must be stated with regard to these conclusions. One difficulty resides in the notion of information transfer. Has information been successfully transferred if students can succeed at certain objective type tests that measure recall of facts, principles and simple comprehension? If so, this

is presumably a very isolated aspect of the whole learning process in which mastery of facts or information would include the ability to place new facts in the context of the whole subject area, the ability to apply given principles in new situations, and so on. If these abilities are some of the goals of learning then it seems pointless to consider the teaching of fact or principle in isolation from them.

In experimental situations, however, it appears difficult to test systematically for anything else but simple recall of fact and principle. The possibility arises therefore that lectures come to seem effective vehicles only for the transfer of information precisely because this particular objective is the one most easily tested.

A further difficulty inherent in the kind of research cited above is its tendency to ignore the specificity of its particular parameters and, through overlooking this specificity, to make wide ranging and unsupported generalisations. No research for instance makes reference to the specific cultural context in which it has been conducted. By ignoring such factors it has an inherent tendency to universalise its results as if all lectures in all times and places can only effectively achieve such and such <sup>an</sup> objective. Consideration of the origins and history of the lecture reveal a wide range of different contexts of use all of which affect its nature and viability. We find, for instance, that it made its first recorded appearance in ancient Athens where it grew up in the context of the classical Greek democratic process wherein according to McLeish "the training of the citizen in the arts of oratory was one of the prime tasks of the educational system". In this context "the living

personality and the trained delivery of the teacher were of paramount importance in presenting materials of human interest to a highly receptive, but at the same time critical and thoughtful audience". The underlying implication is that under different historical conditions in a different cultural context with a different or more limited range of available media the lecture may well be able to achieve purposes beyond it in a different setting. We find for instance that the lecture became established as the prime method of university education during medieval times - that is, during a time when books or manuscripts were scarce and expensive. It would seem clear therefore that the possible roles of lectures are not universally definable but may well vary from setting to setting and from culture to culture.

## II STRUCTURE AND ORGANISATION

### (A) The Pedagogic Viewpoint

In his book What's the Use of Lectures, Bligh sets out a typology of seven basic forms of lecture distinguished according to their organisation. We can briefly summarise four of these basic types as follows:

#### 1. The hierarchical classification.

The most appropriate form for conveying information by surveying an area of knowledge is through a lecture organised in terms of a hierarchy. Lectures organised in this way set out the information

under a set of main headings and sub-headings diagrammatically as follows:

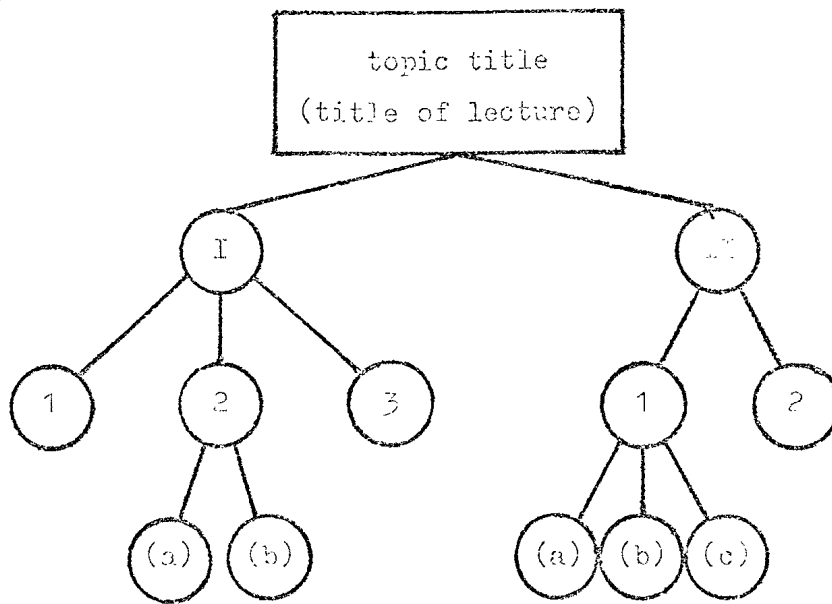


Fig. 1. (after Bligh, 1972): An example of the classification hierarchy form to show 'links'.

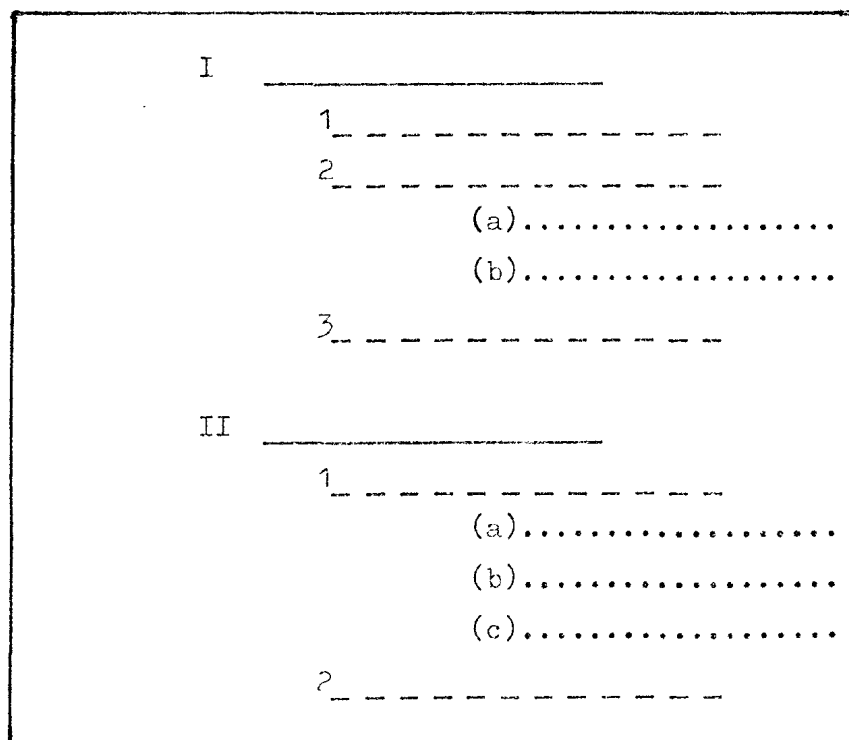


Fig. 2. (after Bligh, 1972): Sequence and probable blackboard organisation of a hierarchic lecture

## 2. The problem-centred lecture.

In this type of lecture the lecturer begins by posing a question or presents a problem and proceeds to set out possible solutions. Under each possible solution is clustered a set of facts, arguments or hypotheses which bear on its validity. This type may take the form for instance of a telescoped presentation of a scientific investigation. It bears some similarity to the hierarchic classification in so far as it is constituted by three levels: the problem; the possible solutions; and the sets of facts, propositions and hypotheses which bear on each offered solution. It differs from the classification method in as much as its presentation takes the form of an ongoing inquiry. Bligh remarks that "it involves some dramatic skill to convey puzzlement, the use of rhetorical questions, and considerable skill in timing the presentation of the next piece of evidence or when raising objections to the latest hypothesis". If this can be achieved it makes this form suitable for stimulating student's interest if the problem can be made to arouse their curiosity.

### Diagrammatic presentation of Problem Centred Lecture

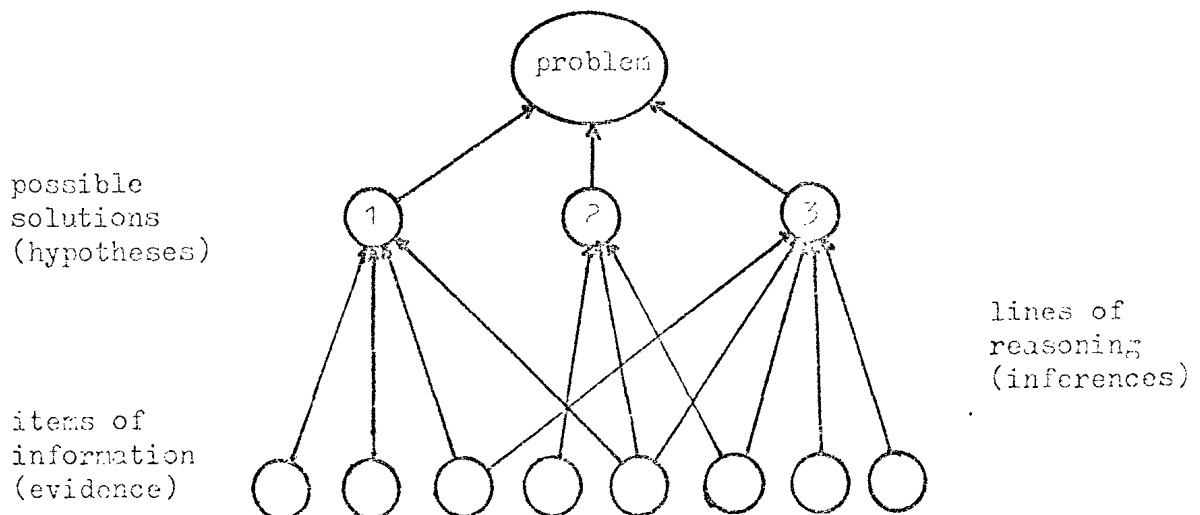


Fig. 3. (after Bligh, 1972): Diagram to illustrate the problem-centred lecture form

### 3. Chaining

This form is most appropriate for presenting an argument that moves step by step to a conclusion. Each stage in the argument represents a link in the chain. A feature of special importance in this form of organisation is clarity when moving from one link or stage in the argument to the next. Accordingly Bligh recommends that the lecturer write these stages on the board or on some other form of visual display such as the overhead projector. Once the stages have been written on the board much of the lecturer's energies may be devoted to explaining why each stage follows from the previous one. It is also suggested that this form of lecture include sections which take stock of or recapitulate previous stages or links in the chain of the argument. It may be represented diagrammatically as follows:

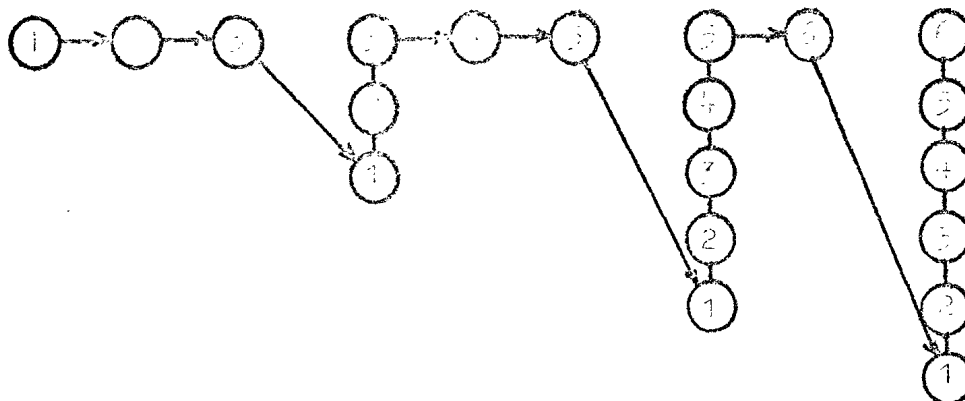


Fig. 4. (after Bligh, 1977): Diagram to illustrate the organisation of a six-point chaining lecture with a summary and two periods of taking stock

### 4. The Network

A more specialised form of lecture organisation is exemplified by "the network" type. This is the most appropriate form for dealing

with subject matter that comprises factors linked by complex sets of inter-relationships. If the aim is to concentrate on the inter-relationships then the best strategy may be to set up the network visually and work through it more than once, dealing with different sets of interrelationships on each occasion. A possible network representing a lecture in group dynamics is set out below with Bligh's accompanying gloss.

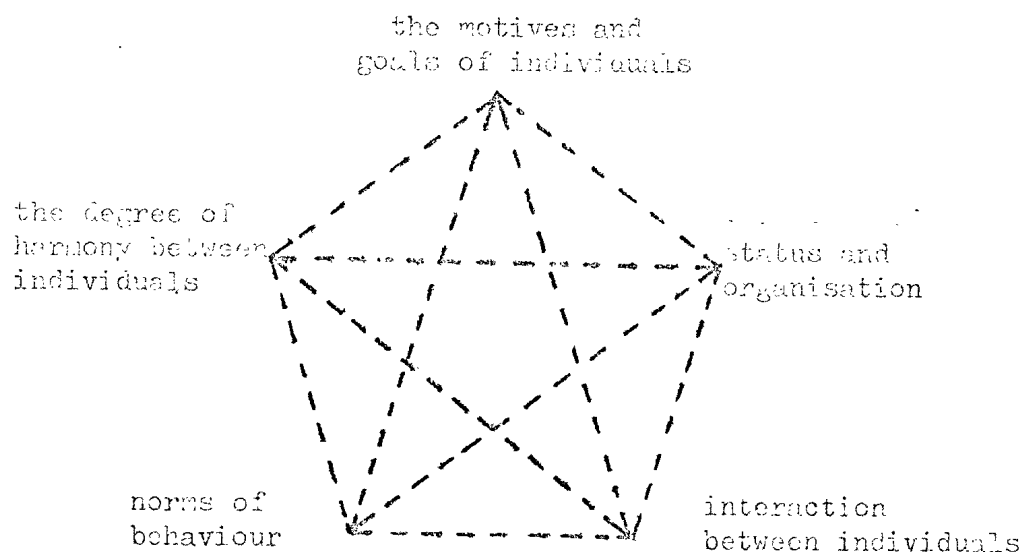


Fig. 5. (after Bligh, 1972): An example of a network. A lecturer in group dynamics was concerned with the question 'What is it that makes a number of people a "group"?'. He wished to consider five factors which were so interrelated that they formed a network.

The various types of lecture organisation are actualised by drawing on a set of common strategies. These strategies or techniques include a kind of meta discourse devoted to making the overall organisation clear or keeping it in focus. These include stating the projected organisation at the beginning of the lecture, itemising each point as it occurs and building up a visual display of these itemised points either before or during the lecture. He also



recommends a process of taking stock and summarising which may occur throughout the lecture but certainly at the end. "Points" are "items of information" (where information may denote principle as well as fact) and constitute, as it were the skeletal structure of the lecture. As a general rule, Bligh argues, making a point should have six stages.

- (i) Concise statement: the point should be stated in as concise a form as possible. "This may be a simple sentence of seven or eight words with one key word or phrase in it, particularly if the point to be taught is a concept".
- (ii) Display: the keyword or phrase should then be incorporated into some form of visual display as part of the progressive build up of the lecture. This process says Bligh, provides repetition which is a valuable aid to memory. It also clarifies the organisation of the lecture and facilitates note taking.
- (iii) Re-expression: the point should be reiterated in an alternative formulation.
- (iv) Elaboration: the point should then be elaborated - a process which may take a variety of forms:
  - (a) the lecturer may add more detail to his original exposition;
  - (b) he may illustrate his original statement of the point by, for instance, providing statistical

information or by using models, pictures or other forms of visual aid;

- (c) the point may be further elaborated by means of explanation;
- (d) it is also useful to relate the point to other areas of the subject and to the students' own experience;
- (e) this may be done by means of examples which, Bligh argues, should be brief, familiar and in concrete terms.
- (v) Feedback: there should also be opportunities for feedback. Bligh argues that if a point is worth making in the first place then it is worth ascertaining whether or not it has been understood before proceeding to the next;
- (vi) Recapitulation and Restatement: finally there should be some kind of recapitulation and restatement. Recapitulation consists of a brief reminder of examples, illustrations and evidence. Restatement consists of repetition of the key statement.

Even this short summary of Bligh's account of lecture types and their organisation raises serious problems. It is difficult for example to determine the exact status of his account since it operates both descriptively and prescriptively. At times it has the features of a descriptive account (the chaining form, for instance, "simply consists of a sequence"). Elsewhere it is clearly prescriptive (taking stock within the chaining form should be done with increasing frequency as the lecture progresses). The ambiguous status of the

account has the corollary of raising uncertainties about what is being described. The forms of lecture organisation seem simultaneously to be actually occurring instances of organisation (cf. diagram for network lecture), idealisations from data, and models to be imitated. There is a further ambiguity about how much these forms of organisations constitute 'projects' in the form of a lecture plan and how close they come to actualisation in sequential monologue. In this respect there seems to be a difference in the two levels of organisation - the overall level and the lower level realised in "making a point". This difference can be restated in terms of the difference between organisation constrained by the content or subject matter, and organisation constrained by the medium.

If we look at the chaining form, for instance, we can see the chain as appropriate only when subject matter may be stated in the form of an argument, but actualisation of that form requires recapitulations - a feature of organisation derived from the constraints of the medium. This problem of "plan" v "actualisation of plan" becomes clearer if we consider the network form of organisation. The diagram of this form refers clearly to a particular organisation of subject matter. In its actualisation however the nature of extended monologue requires that points would have to be made sequentially. Consequently the actual structural organisation of the network lecture as delivered may not differ markedly from the chaining form or the hierarchic classification. It may be possible to blur some of these distinctions for pedagogic purposes but it is difficult to see how clear recommendations can be made about lecturing technique without some reference to what actually happens in practice.

(B) The Discourse Analysis Viewpoint

- In the light of this remark it is especially useful to consider R.Straker Cook's (1975) analysis of an actual soil physics lecture.

Straker Cook's area of interest is the discourse structure of lectures, i.e. the level of linguistic organisation in an extended monologue, operating above the sentence, that accounts for its coherence. This work is undertaken in the context of preparing comprehension materials for students attending lectures in the medium of English where English is their second language. Straker Cook believes that not all difficulties in comprehension for these students relate to intrasentential factors: there is a further level of difficulty related to problems of understanding strings of sentences as pieces of ongoing discourse with their own principles of coherence. Comprehension involves not just processing the smaller units of structure such as clause and sentence but also recognising the devices that relate utterances together in a particular communicative situation. The difficulty has been summed up by one student in the words: "we understand the English but can't follow the lecture".

Straker Cook's analysis of a soil physics lecture is based on previous work on classroom discourse by Sinclair and Coulthard (1975). Their research dealt with explicitly interactive discourse but Straker Cook retains their use of a rank scale to identify units of the rhetorical organisation of lecture monologues. The rhetorical organisation of lectures is thus seen as being hierarchical in nature, consisting of five main ranks: lecture, exposition, episode, move and act. The structure of each rank consists of units, either singly or in combinations, from the rank immediately below. Thus,

lectures are made up of expositions which in turn consist of episodes. Episodes are made up of moves and moves are made up of acts.

Straker Cook's analytic model is complex and extremely detailed at the lower ranks. He identifies, for instance, seventeen classes of act at primary delicacy and these in turn are subdivided at secondary delicacy to provide in all twenty-seven different ways of classifying acts. This detailed complexity makes the composition of his system difficult to summarise without over-simplifying it. We will proceed however by describing the smallest units of structure, giving some examples of units from each rank during the course of the description.

(i) ACTS: The category of act was formulated by Sinclair and Coulthard (1975) to take account of the discrepancy between grammatical forms, such as interrogative, declarative and imperative, and the functions they perform in discourse. Not all declaratives make simple statements about the world, for instance. Some can be seen as performing actions such as asking, checking, clarifying and so on. Discourse acts are typically one free clause, plus any subordinate clause, though there are certain closed classes where it may be possible to specify almost all the possible realizations which consist of single words or groups. They are identified on the basis of their role or function in creating continuous discourse. Thus certain acts have the function of marking off one piece of discourse from the next. In classroom discourse we find framing devices such as "now", "well". In lecture discourse we find markers of transition such as "here again", "to take an example". Straker Cook identifies other markers

such as markers of contrast exemplified by "but", "yet", "whereas", "however". Further examples of discourse acts identified by Straker Cook in lectures are set out below.

Propositions: (headings); these occur at or near the beginning of episodes and serve to introduce the "topic", so to speak, of the ensuing discourse. It can be seen as similar to Bligh's "key phrase" in making a point. Straker Cook gives as a typical exponent, "the realised effect of temperature".

Statement: (assertives); e.g. "here the aggregation tends to reach its maximum".

Statement: (physical status and properties); "they've never drawn a drop of water they were as fresh as the day they'd been put in".

Statement: (summary); "you'd never find a well structured podzil but you'll always find or usually find a well structured chernozem".

Metastatement (retrospective); "if we look at the relationship between aggregation and not rainfall but erm increasing temperature".

Ordination: "also / to come to the second point / the effect of your  
marker / ordination / proposition  
rotational system".

(ii) MOVES: Acts, either singly or in combination make up moves. The previous example of an ordination ("to come to the second point") occurs in combination with two other acts, a marker and a proposition. These three together provide one possible realization of a focussing

move of the type which introduces episodes. In addition to focussing moves Straker Cook identifies eleven other main classes of move including such types as describing, asserting, relating and summarising moves. The following is an example of a describing move.

"this is when the dagger point was reached when your stabilising DES (statement) (causative)

factors were decreasing and decreasing until finally they reached (resultative)

a level where even when you put the soils back into grass you (qualification)

saw no result for it"

Focussing and concluding moves occur at the boundary of episodes within which other moves - such as describing moves - play an extending role.

(iii) EPISODES: These, as we have seen are realised by an initial opening move and final concluding move within which occur selections from the other kinds of move. They vary in length from  $\frac{1}{4}$  minute to  $3\frac{1}{2}$  minutes in the sample soil physics lecture and consist of four main types: expectation, focal, developmental, and closing episodes each type being distinguished on the basis of a subclassification of the focussing and concluding moves that occur at their boundaries. A typical exponent of a closing episode would be the following:

" so that um this question of cultivation then I say the think about  
FOC (marker) (proposal) ASS suggestion

the ataberg limits you can produce a suitable aggregation size  
(statement; assertive)

distribution in the soil but unless you've got your stabilising

CON<sub>4</sub> (qualification)

factors in that soil then its not going to be very much good "

(statement; summary) pros

Episodes combine together to make up expositions which are often coterminous with lectures. This summary of Straker Cook's analytic model gives some idea of the range of speech acts identifiable in lectures and the devices that provide for their articulation in extended monologue. The main problem with his analysis seems to be its very particularity at the lower ranks and the manner in which subclassification or subdivision of categories takes place at these ranks. The main criteria for this subclassification seem to be of the notional or semantic type, the use of which creates problems in coding data. It is not always easy to distinguish between exponents of one kind of act as opposed to another in the data. It is for example not altogether clear why an exponent such as "here the aggregation tends to reach its maximum" should be coded as an assertive statement, whereas "here's the type of moisture characteristic curve you're going to get" should be coded as a statement of physical states and properties.

Furthermore the use of notional or semantic criteria leads to a taxonomy of acts that may well be highly content specific and may limit the general applicability of the system. In this respect we need to know how well the system would fit data from other kinds of lectures.

It seems in fact that we could distinguish between two main



kinds of act in Straker Cook's account: acts such as statements of operations, justifications, causatives, resultatives, and qualifications, all of which seem closely rooted in content or subject matter and may well vary in distribution from lecture to lecture; and acts such as boundary markers, metastatements, summaries, reformulations, and so on, which seem much more clearly related to the suprasentential organisation of monologue discourse irrespective of its specific 'content'. The former could loosely be termed speech acts and the latter referred to as discourse acts.

Straker Cook's isolation of generalised speech acts in lectures such as defining, qualifying etc., makes good sense in the context of developing listening comprehension materials for a notionally oriented language programme where the emphasis is on "the kind of thing a speaker needs to say" or "the notions that the learner will expect to be able to express through the target language". But study of acts such as markers, metastatements, etc. is likely to reveal more about the overall discourse structure or organisation.

If we consider the relation between Straker Cook's analysis of a lecture and Bligh's account of their overall organisation from a pedagogic view-point, we find some points of overlap, especially between Bligh's 'making a point' and Straker Cook's episode. The latter's 'focussing move' bears some comparison with Bligh's 'concise statement'. 'Summarising' moves are comparable with 're-capitulations', and 'relating' and 'explaining' moves coincide with some of Bligh's procedures for elaborating a point.

Straker Cook's account, however, specifies the processes involved in much more detail and shows either a different ordering or constraints

on ordering not recognised by Bligh. In Straker Cook, for example, justifying, qualifying, contrasting and explaining moves are in fact 'bound moves'; they can only occur in the environment of a pre-existing free move. Explaining moves, for instance, only follow asserting or describing moves. In Bligh's account explaining is a procedure employed in elaboration of a point with no necessary dependency on other specified activities but usually occurring after an illustration.

It could be argued that the soil physics lecture analysed by Straker Cook is a 'bad' lecture since it does not exactly correspond to the organisation suggested by Bligh. We must accept, however, that the two accounts refer to slightly different types of organisation which may be illuminated by use of an analogy with Chomsky's model of syntax. It is as if Bligh isolates deep structure possibilities for lectures whereas Straker Cook shows the kind of surface realisations that these 'deep structural organisations' may take. Bligh is oriented primarily towards the logical presentation of subject matter whereas Straker Cook takes account of markers of structure which are specifically linguistic in nature and appear in the actualisation of deep structure as text. However, it is precisely these surface markers signalling the ongoing organisation of discourse as discourse, which are important in the understanding of lectures, since it is only through these that any "deep structure" or logical ordering may be inferred.

(C) Audience Receptivity

Research on student retention of lecture material suggests that

there is a correlation between recall of items of information and where these items occurred in a given lecture. One study by Trenaman (1951) revealed that those who heard only the first fifteen minutes of a talk on astronomy remembered as much as those who heard the full forty-five minutes. When tested a week later it was discovered that those who heard the first fifteen minutes remembered twice as much as groups which heard thirty and forty-five minutes respectively. Trenaman deduced that assimilation began to seriously diminish after the first fifteen minutes until at about thirty minutes nothing was being taken in at all. As time went on the total amount assimilated was continually decreasing. He concluded that talks had to be extremely carefully structured and directed towards a highly selective audience for even minimal effectiveness.

Results like those obtained by Trenaman are variously interpreted. Psychological investigation of performance at vigilance tasks shows understandably that there is progressive deterioration over a given span of time at the task. In terms of lectures we can presume that the audience's level of attention drops during the time of delivery.

Psychological investigation also shows that learning measured on tests of memory can suffer from two kinds of detrimental effect: (1) Proactive interference where what is learnt subsequently is deleteriously affected by what is learnt first; and (2) Retroactive interference where what is learnt first is inhibited by subsequent learning.

The probable operation of these phenomena on lecture audiences have prompted a number of studies similar to that undertaken by Trenaman. One such study was undertaken by McLeish (1966) who set out to investigate how much lecture content is carried away by students,

whether in their heads or in their notebooks. His lecture audience was divided into three groups. Group I remained for the whole lecture; group II left after forty minutes; and group III attended only the first twenty-five minutes. There were also two control groups involved in the experiment, neither of which actually attended the lecture although one was supplied with a duplicated outline of its content. Each group was tested on recall of content by an exam involving multiple choice items, true - false statements, matching items, paragraph completion items and factual questions which required the briefest of answers. Subjects were allowed the use of notes in completing this exam.

McLeish's main finding was that students were able to carry in their heads and their notebooks not more than 42 per cent of the lecture content. A more detailed breakdown of the findings may be represented as follows:

LECTURE	PART I	PART II	PART III	TOTAL
POSSIBLE GROUP SCORE	181	134	199	514
GROUP I:	79 (44%)	34 (25%)	96 (48%)	209 (41%)
GROUP II:	99 (55%)	46 (34%)	0	144 (46%)
GROUP III:	72 (40%)	0	0	72 (40%)
TOTAL	250 (46%)	80 (30%)	96 (48%)	426 (42%)

On the basis of these figures McLeish argues that the decline in performance of students in Trenaman's investigation is not borne out by his own experiment. This assertion is based on the fact that students who attended the whole lecture were able to recall nearly

half of its last section (more in fact than they were able to recall of its first part). Students who heard the whole lecture were also able to recall more of its first part than group III who heard only this section.

Nonetheless there is still a decline in receptivity during the middle section of the lecture when the performance of both groups I and II deteriorates. This decline in assimilation may be related to differing levels of content during the lecture; perhaps part II was intrinsically more difficult than parts I and III. But the performance of group I at least bears some relation to what psychologists have termed 'the serial position effect'.

The serial position effect refers to the way in which experimental subjects who are required to recall a string of items have most difficulty recalling items from the middle section of the string. This difficulty is interpreted as being the result of both proactive and retroactive interference on items in the middle. In McLeish's experiment group II's deterioration in performance during the second part of the lecture may be interpreted as the result of proactive interference whereas group I's greater deterioration may be seen as the cumulative effect of both proactive and retroactive interference.

The possibility of this effect occurring in lectures was explicitly investigated by Johnson and Calhoun (1969) in a study entitled, "The Serial Position Effect in Lecture Material". In this study they describe how two groups were presented with a tape-recorded eight minute lecture on principles of science. The first group was presented with the lecture in its original form. The second group was

presented with the same material but in a rearranged form whereby the middle portions of the lecture were extracted and placed at the beginning and end. Both groups were tested for recall of information from the two recordings and in each case (as a general trend) it was observed that both groups recalled less of the middle sections of the tape-recordings.

Johnson and Calhoun interpret this finding in terms of the serial position. What they do not explain, however, is the differences in performance of the two groups. This can be seen most clearly in the following diagrams.

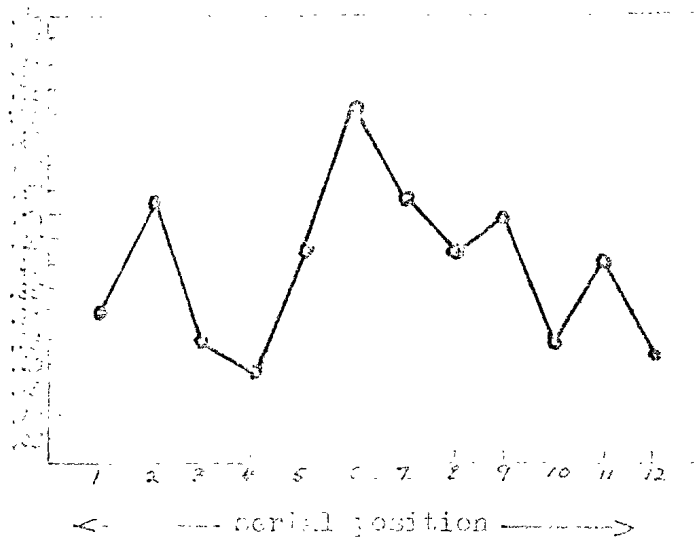


Fig. 6(a): Serial position curve for Group I  
(Lecture material in original order)

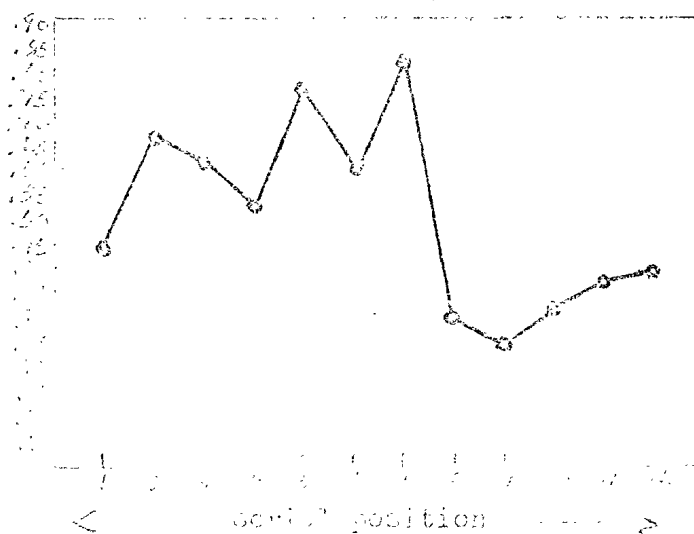


Fig. 6(b): Serial position curve for Group II  
(Lecture material in rearranged order)

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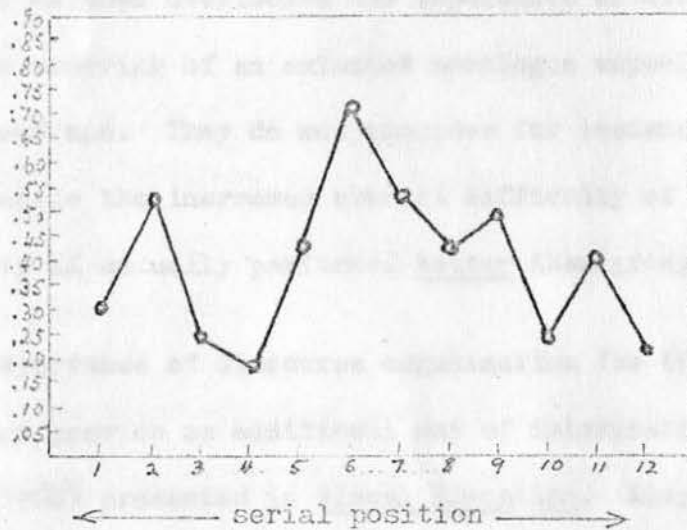


Fig. 6(a): Serial position curve for Group I  
(Lecture material in original order)

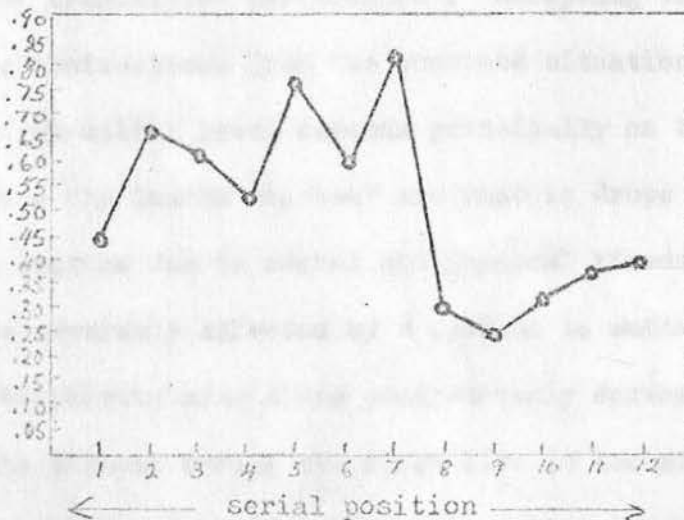


Fig. 6(b): Serial position curve for Group II  
(Lecture material in rearranged order)

Johnson and Calhoun comment: "The investigators are unable at this time to present a definitive explanation for the differences observed in the two orders. It appears that the rearrangement of the lecture material from the form in which it was originally written increased the overall difficulty. Why this should be so is not apparent since paragraphs which were changed had no apparent relation to each other and the two forms seemed to be equally cohesive". (p.257)

The assertion that both forms "seemed ... equally cohesive" is difficult to assess without transcripts but it seems likely that Johnson and Calhoun overlooked the importance of discourse organisation in the ordering of an extended monologue especially at the beginning and end. They do not consider for instance why at certain points, despite the increased overall difficulty of the rearranged order, group II actually performed better than group I.

The importance of discourse organisation for the coherence of lectures may provide an additional way of interpreting some findings of Lloyd (1968) presented in Visual Education. Lloyd's basic thesis is that "assimilation is a direct function of scholar receptivity and lecturer transmitted performance". Accepting that these two factors are abstractions from the concrete situation, Lloyd argues that "the transmittal level depends principally on the time which has elapsed since the lesson started" and that it drops progressively during the lecture due to mental and physical tiredness, though it can also be adversely affected by a decline in audience receptivity. Audience receptivity also drops progressively during the lecture, being at its highest during the first five to ten minutes. Unlike the transmittal level however there is a sharp improvement in receptivity during the last few minutes of the lecture.



The interplay between these two factors and their consequent effect on assimilation may be represented diagrammatically as follows:

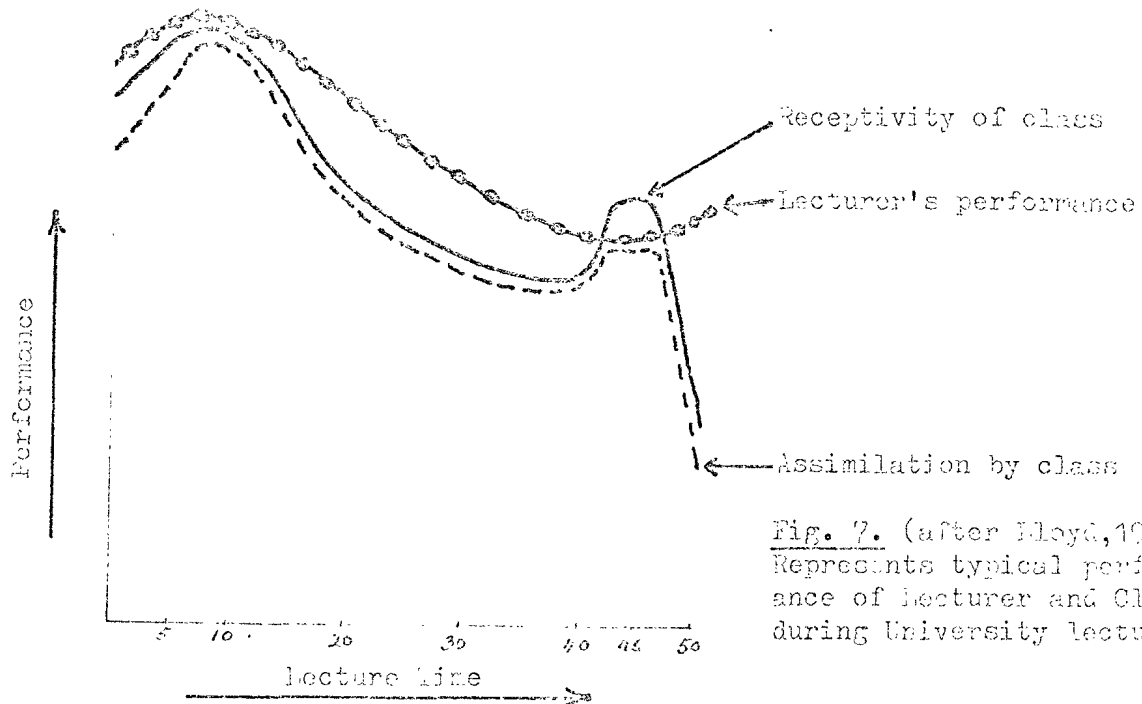


Fig. 7. (after Lloyd, 1968). Represents typical performance of lecturer and Class during University lecture.

One way of interpreting the decline in class receptivity is in terms of a fall in attention during what constitutes a prolonged auditory vigilance task.

But Lloyd opens the door to an alternative or complementary interpretation when he remarked that the fall in receptivity "is due more to mental confusion and boredom than mental and physical fatigue". The underlying implication therefore is that mental confusion is primarily associated with the middle portion of a lecture rather than the beginning or end. This mental confusion is possibly produced by the difficulties of structuring an extended monologue "in media res". Conversely, the higher level of receptivity at the beginning and end of a lecture may be related to the greater clarity of discourse structure at these moments.

If we assume a relationship between clarity of discourse organisation and quality of audience response to that discourse, then a fruitful area of study would be the differing kinds of

discourse organisation throughout the lecture.

On the basis of the kind of research cited above, educationalists have recommended a more flexible and varied approach to lectures. They suggest that whenever possible there should be variation in activities especially during the middle of the lecture when student receptivity is at its lowest. Lloyd recommends the use of visual displays, models etc. during this phase. Gregory argues for a complete change of activity from listening to doing - for example, by combining exposition with the asking and answering of questions. This may even take the form of a five minute test, a suggestion which fits in with Bligh's notion of obtaining feedback. Bligh himself explores the possibility not only of lecturer-student interaction, but also interaction among the students themselves. Various forms for this interaction are suggested such as "buzz" groups for example, or problem centred groups.

"Buzz" groups are groups of two to six members who discuss issues for a short period or periods within the lecture. It requires no special seating arrangements, members of the audience merely talking over a particular issue with their immediate neighbours for a few minutes. Problem centred groups on the other hand, tend to be larger, involving as many as twelve members. They operate more formally than buzz groups in so far as they may be required to work through a problem presented to them in stages or in individual components. They also require a more formal seating arrangement, whereby the audience is seated in groups around tables to form a C or V shape with the open end facing either the centre or front of the room. The lecturer's function in this situation is to expound

the problem at the beginning and to sum up at the end. The intervening period between initial exposition and final summing up can be spent in moving from group to group in order to assess progress and give help when needed.

These hybrid lecture forms have two main advantages. They involve the audience to a greater extent in the learning process and they also provide them with some variation in activity. Bligh argues that if the lecturer returns to an expository monologue after a switch in activities the students' level of attention will have returned to that associated with the beginning of the lecture.

### III EVALUATION

Evaluation of lectures has been mainly comparative in nature: studies have sought to compare the relative effectiveness of lectures with other teaching methods such as seminars, discussions, tutorials, laboratory work, self-instruction and so on. Their results have been summarised in various reviews such as Dubin and Taveggia (1968), Bligh (1972) and Costin (1972). The general consensus of opinion is that lectures are as effective as other teaching methods when it comes to communicating information, but where the aims of teaching include the promotion of skills (such as logical thought) or the arousal of interest, then other more active learning situations may be appropriate. If lectures have to be used for other purposes than the transmission of information then most research points to making them as unlike lectures as possible.

One fundamental problem arises throughout all this comparative

research. Little attempt is made to specify exactly what is meant by a lecture nor to describe what transpired in the lectures under consideration. As Bligh (1972) remarks: "Few details of teaching technique appear in the experimental reports, but these may be as important as the choice of overall method" (p.49). The lecture method may be highly effective employed in one fashion by one lecturer, but quite ineffective employed differently by another. Costin quotes Lumsdaine's powerful criticism on this point:

"Since there are variations within each method, unless well defined sampling procedures are enforced ... no way is available, generally speaking, to establish that the difference revealed, if any, is attributable to the 'method' rather than to the manner in which it was employed. A good film will always beat a poor lecture - and vice versa".

The basic issue then becomes one of evaluating lectures in themselves and deciding what are the criteria for a good lecture.

"The problem," suggests Lumsdaine, "is to conduct investigations so that they can be employed as a basis either for selecting superior lecturers or for defining those elements of a lecture procedure that can be transmitted, with predictable results, to those to whom the procedures are to be taught".

The other main kind of evaluative enterprise connected with lectures is the student questionnaire. These give some indication of whether or not students are satisfied with the lectures they receive,

but in this respect they tend only to confirm the investigators prior intuitions on the matter. No one has yet specified on what these intuitions are based. As a tool for constructing a model of a good lecture they seem far too unwieldly and if the aim is really to obtain some feedback on students' reactions to a lecture or lectures, then some more direct method of consultation would surely be preferable.

### CONCLUSION

Whether the aim of research on lectures has been to evaluate them against other teaching methods, to solve problems of the non-native speaker of the language in which lectures are conducted, or to make prescriptions from a pedagogical view point about how to lecture, this research would benefit from a closer observation of the actual process of lecturing. This process is both reflected and constituted in language.

The language of lectures thus has obvious relevance in considering the problems of learning in a non-native medium. But it has further relevance in achieving many of the other aims of educational research. Attention to the language of lectures has relevance in distinguishing between one kind of lecture and another and in constructing a typology of lecture forms. It would have further relevance in defining the particular techniques that make up a good lecture - we can at least specify these techniques in terms of the language habitually associated with them. And, if we wish to make prescriptions about what good lecturers should do, then it is useful to know whether or not these prescriptions are

allowed for by the constraints of the linguistic code.

A discourse analysis of extended monologue - the speech genre most commonly associated with lecturing - should provide categories and insights relevant to these issues.

## CHAPTER TWO

### SUPRA-SYNTACTICAL ORGANISATION IN LECTURE MONOLOGUE.

1. PRELIMINARY REMARKS: INTERACTION AND STRUCTURE IN LECTURE MONOLOGUE.

In its widest sense the study of discourse can be seen as an attempt firstly to render the interactive properties of talk and secondly to show that this talk displays a predictable order and structure.

Occasionally these twin aims come into conflict and the interactive property of talk is displayed with little sense of its structure; or, conversely, its structure is clearly delineated without illuminating our sense of what constitutes interaction. However, insofar as 'people talking' mutually collaborate in an enterprise that unfolds successively in real time, it would seem axiomatic that these twin aims be maintained as complementary.

In the study of multi-party discourse both its 'structuredness' and its 'interactiveness' are simultaneously revealed through the rather self-evident phenomenon of speaker-change. A feature of this type of talk is that participants take turns at talk in sequence and the very sequential nature of the turn-taking provides a resource for analysing structure boundaries being placed by an analyst at points of speaker change. Accordingly, the study of speech events involving more than one interlocutor usually adopt speaker change as a methodological starting point.

However, most lectures observed in the preparation of this study consisted of uninterrupted talk by one person, a continuous monologue. Occasionally a lecturer will exchange speaking turns with a member of the audience but the most common practice is for him to address the audience without pausing for, requesting, or even allowing contributions from another participant. By the common consent of all parties



to the speech event the operation of speaker-change or turn-taking is clearly suspended.

Accordingly a preliminary procedure for isolating basic units of the discourse is absent. Furthermore, as a corollary of this absence, we find that types or classes of basic unit identified by their correlation with speaker change in terms of their influence on the subsequent unfolding of the discourse, are also absent. Thus monologue discourse itself, when considered in the terms of one well known method of discourse analysis (see Sinclair and Coulthard, 1975), exhibits no 'eliciting acts' (which require a verbal response), practically no directives (which require an immediate non-verbal response) and of course - by definition - no responses.

It could be argued in the light of these observations that the monologue discourse of lectures is basically a non-interactive mode. There is however good reason to suppose that even when the lecturer does not actively exchange utterances with his audience he is nonetheless considerably influenced by their presence. Anyone who has felt nervous in the face of a large audience knows this to be so. We can however also point to features of the language itself. Use of the personal reference system can vary considerably in the course of lectures. The 'you' - and 'we' - pronouns for instance, are standard ways of referring to speech roles within the situation and are

used to refer to the audience or to the lecturer and audience combined as in the following.

1 ex. 1    "you'll forgive me if I don't write everything out  
          every time because we've still some way to go"

A. 12/22-23

- 1 ex. 2 "when I drew this simple theoretical circuit here you realise I didn't actually draw in the power supply"

A.23/15-16

- 1 ex. 3 "So we shall be concentrating on amplifiers ... analog amplifiers"

A.18/15

These first and second person plural pronouns vary however in their field of reference to include more than those actually present to the speech event. 'You', like 'one', can be used to denote any human individual. 'We' is used in similar fashion but more concretely, implying a particular group of individuals with which the speaker wishes to identify himself. These latter kinds of uses of 'you' and 'we' can be isolated by two complementary criteria: they can be replaced by the impersonal 'one'; or clauses in which they occur can usually be recast in the passive. Some examples are as follows:

- 1 ex. 4 "/now we can choose the amplitude of the signals we feed in from these two oscillators/and we can also choose the frequency/thus we can feed this into the amplifier with a frequency F1 and this with a frequency F2/and what we should get at the output is an amplified version of this signal added to that signal"

A.25/29-34

- 1 ex. 5 "/this is important/there are so many different types of device currently on the market that if you had to understand the precise operation of each one of them you'd spend all your time doing that/you'd never get around to actually designing any circuits using them/

A.29/2-6

- 1 ex. 6 "/sometimes you find that the sepals are quite separate and you can take er a pair of forceps and pluck them off one by one/sometimes you find that they are joined together/"

A.36/20-23

- 1 ex. 7 "/if we are dealing with a fairly young anther and er if we look at this under the microscope - this young anther in say a flower bud - then we will see er some differentiation of tissue in the section/"

A.42/18-12

In these examples the first and second person plural pronouns can be taken as denoting "the scientist", "the impartial observer" or perhaps more specifically "the botanist", "the mathematical physicist" - a practitioner of the subject matter of the discourse. This kind of generalised reference is probably a feature of the size of audience at lectures and represents a hypostatisation of the speech roles of parties to the speech event: the large number of individuals present in the audience are identified in terms of their common characteristics and this in turn allows indefinite extension of the audience to include all members of the same category (botanists, physicists, engineers etc.).

One further use of 'we' which may be noted is the inclusion of the audience in some activity proper only to the lecturer as in the following:

- 1 ex. 8 /what I'm going to do is er put up a sort of general diagram first of all and then we'll er describe the various parts of the flower/

A.35/23-25

- 1 ex. 9 /so first of all we'll write down the term j equals one/then we'll write down the term j equals two/then we'll add them/

A.6-7/38-2

- 1 ex.10 /we shall be talking about essentially analog circuits/

A.18/7-8

1 ex.11 /the ones we shall be talking about most however  
are in fact amplifiers of sinusoidal signals/

A.18/34-35

1 ex.12 /but we in the main shall be talking about  
sinusoidal input signals/

A.22/15-16

The various uses of personal pronouns so far noted can be summarised  
as follows:

WE: used to include the audience in some activity actually being  
undertaken by the lecturer himself.

WE/YOU: used generally in the sense of 'scientist', 'observer',  
'botanist' etc. or indeed in the sense of 'any human individual'.

It must be pointed out however that sometimes these uses shade  
into one another and it is not always possible to identify instances  
as indubitably of one kind or the other. The situation can be even  
further complicated if the lecturer sets up a hypothetical situation  
or problem which includes fictional characters such as 'an early  
electrical engineer', 'a customer' and proceeds to interact with  
individual members of the audience. At such moments it becomes  
clear that lecturers can be afflicted with an acute sense of differences  
within the audience itself as may be shown by the following example in  
which a lecturer comments on an individual student's reply:

<sup>1</sup> ex.13 LECTURER: "/you must have been educated by a fairly  
general physical theoretician/ right/er  
anybody who had a less adequate education  
because that's fairly abstract/it's valid  
in general terms/but I think we've got to  
get to er a somewhat more particular reason  
for arguing that these are sound principles  
to employ/"

On the basis of this analytic sketch of some aspects of the

personal reference system as it is employed in lectures, I would claim that the normally sensitive lecturer has a shifting sense of his audience. He addresses himself not only to those immediately present but also attends to (perhaps unconsciously) a 'court of expert opinion' provided by his sense of the known habits of formulation amongst specialist practitioners in his subject area. Furthermore, within the immediately present audience he can hardly overlook the differing abilities and backgrounds of his listeners especially if he engages in dialogue with any single one of them.

This shifting, internalised image of the requirements of the audience has a reciprocal effect on the discourse itself.

It was noted earlier that monologue of its very nature lacks such fundamental discourse 'acts' as 'elicitations' or even 'directives'. Does the lecture then consist primarily of 'informatives'? At a crude level it may be seen as such, but an analysis in these terms would suggest that the speech event is much more monolithic and undifferentiated than proves to be the case. For over and beyond the lecturer directly "informing" his audience he further undertakes a considerable amount of reflexive activity in which he attempts to tailor the unfolding discourse to the shifting requirements of his internalised audience-image. We may illustrate this activity in the following examples in which the lecturer repeats, reformulates or qualifies some aspect of the unfolding utterance.

1 ex.14     /and er these er buds in general have the  
             characteristic of indefinite growth/once  
             they begin to develop they go on and on.

A.34/32-34

1 ex.15 /as such its a source of power/it's a direct  
current source.

A.23/2-3

1 ex.16 /all these equivalent circuits are experiment-  
ally determined/at least they have a basis in  
experiment.

A.29/26-27

It is difficult to regard the latter parts of these utterances as totally undifferentiated from the former. If each example begins with an informative then it would seem to conclude with some kind of subsequent 'gloss'. By reflecting back on itself in this way the discourse takes account of the shifting requirements of the internalised audience image.

Insofar as lecture monologue takes account of the listener and displays some orientation towards the hearers possible reactions it is clearly an interactive mode. Consequently - despite the absence of speaker change - we would expect some partitioning of the speech into units. What, therefore, are the clearly identifiable structures of lecture monologue?

Initially we can point to two main types of structure - a large scale and a small scale. The large scale structure is primarily identifiable by the kinds of activity which occurs at its boundaries. At these points the lecturer 'focuses' the previous or subsequent direction of the discourse by statements such as:

1 ex.17."/so the point that I'd like to make is that you must suit  
the complexity of the mathematical model that you use to the  
application that you have in mind/"

A.29/33-36

ex.18    "/I shall mention two other definitions because  
          er we will need them later er although they won't  
          mean much to you now/"

A.5/14-16

Such focuses, either as prospective metastatements or concluding statements have been fairly well documented both in lectures and in other situations (see, for example, Straker-Cook, 1975, Sinclair and Coulthard, 1975, and Stubbs, 1975) and they are treated in more detail in chapter III. Suffice it is to say for the moment that they serve to punctuate often quite extended passages of discourse. It is interesting to note that in doing so the lecturer intrudes himself into the discourse. Evidence for this statement may be adduced once again from the personal reference system. The norm in lectures is for no first person singular reference. Where it occurs it is usually in the context of clauses containing meta discourse items such as 'lecture', 'example', 'point', 'definition' or main verbs such as 'think', 'promise', 'illustrate', 'show', 'exemplify', 'say', 'mention'. Such items correlate sharply with boundary activity and though they occur elsewhere in the discourse it indicates that the presence of the speaker is particularly intrusive at points of focus. In short larger scale structuring of the text typically foregrounds interpersonal components of the speech event. At this point on the scale 'structure' and 'interaction' go hand in hand.

Identifying smaller scale structuring in lectures is more problematic. One noticeable feature of the data however is its relative "well-formedness" in syntactic terms. Despite the fact that no lecture forming the data corpus was read from a prepared script but each was improvised with only occasional reference to notes, the transcripts, at least in syntactic terms, show comparatively few of Chomsky's "false starts, deviations from rules, changes of plan in mid-course,

and so on" (see Aspects of the Theory of Syntax, 1965, p4). Indeed it was a fairly easy task to isolate syntactically discrete units which are shown in the transcript as bounded by a single stroke (/). Such units consist minimally of one Free Clause. They may contain more than one Free Clause if structures of the branched type are involved where a close relationship (involving elision of a necessary element of clause structure) obtains between the clauses. They may also contain more than one clause if the further clauses are "Bound" or syntactically dependent on the Free Clause.

The exact status of such units - whether they should be seen as belonging to syntax or to some further level of linguistic organisation - is of course a moot point at this stage of the enquiry. On the one hand discussion has centred on discourse. On the other hand units have been identified on syntactic criteria. It should however be noted that the syntactic criteria have been applied negatively with the implication that syntax as normally conceived of operates within these units but not between them. If they are syntactically discrete how then are they related to each other as the speech unfolds? Are they merely tied together by devices such as lexical repetition, substitution, reference and conjunction or do they combine together in some kind of constituency relationship to form the larger scale units bounded by focussing activity? The following section addresses itself to these and related questions.

## 2. COHESION OR DISCOURSE?

Sociolinguists concerned with the structure of speech events (e.g. Hymes, 1972; Laboř, 1970, 1972; etc.), literary critics concerned



with the structure of narrative (e.g. Propp, 1968; Frye, 1969 and Barthes, 1975), and anthropologists interested in describing cultural and social life in structural terms (e.g. Levi-Strauss, 1967) have all shown interest in units of language larger than the sentence.<sup>1</sup> Their interest overlaps with that of linguists themselves in describing the articulation of sentences together in the formation of texts. From the point of view of linguistics there are at present two complementary approaches, that of cohesion and that of discourse. Discourse analysis, so far, has been mainly concerned with the structure of verbal interaction dealt with as a higher level than grammar (in the same way as grammar is seen as a higher level than phonology). Cohesion on the other hand is seen as a description of the resources of the language system for generating interconnected series of sentences in an integrated text. In so doing it does not posit any higher level of units (except perhaps for 'text') but works with units of description located in the grammatical system.

Widdowson (1972) distinguishes these two approaches by terming the study of the cohesive properties of texts - the surface features of sentence connection - 'text analysis'. The study of 'coherence' - the relationship of underlying speech acts - he terms 'discourse analysis'. The distinction is reinforced for him by the fact that certain exchanges can be "coherent as discourse without being cohesive as text" (see Widdowson and Cripser, 1975, p 207). He gives as an example of such an exchange the following:

- A: I want you to write down the answer in your exercise book  
B: My pen is broken.

Widdowson and Cripser comment that although this exchange contains

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<sup>1</sup> E.O. Hendricks, 1967, provides a useful summary of approaches.

"clearly related utterances" it nevertheless lacks any form of textual cohesion.

A number of difficulties pose themselves in connection with the distinction as thus formulated. Firstly, the examples cited of non-cohesive but coherent discourse take the form of an isolated exchange. If such an exchange forms part of a longer sequence (it would be unusual if it didn't) it may well be tied cohesively with what precedes and follows it. Thus, as part of a larger context, it might well prove cohesive in itself. Secondly, some kind of cohesion is in fact operating even within the isolated exchange given above. The utterance by 'A' contains the lexical items "write" and "book". The utterance by 'B' contains the item "pen". All three items insofar as they typically co-occur belong to the same collocatory set. The two utterances can therefore be seen as linked by one form of lexical cohesion.

Finally, the definitions of the terms 'cohesion' and 'coherence' suggest an underlying distinction of a slightly different order. The definition of cohesion as 'inter-sentence connection suggests the written text, since the relevance of the category 'sentence' to spontaneous speech is unclear. Conversely, the definition of 'coherence' as the relationship between 'underlying speech acts' suggests the spoken rather than the written medium - a point reinforced by the kind of example cited of coherent but non-cohesive discourse which proves to be a simulated exchange from the spoken medium. It would seem therefore that the coherence/cohesion distinction is being blurred by a different kind of distinction between speech and writing.

Nonetheless, although the terms of the distinction may be disputed, it is still possible intuitively<sup>11</sup> assent to the claim that an

inventory of cohesive ties in a text will not account for its coherence. It is interesting in this respect to note that Halliday and Hasan (1976) maintain a similar distinction but for the opposite purpose of showing how discourse analysis cannot account for the semantic unity of texts - a unity that makes of texts more than a mere collection of isolated sentences. For Halliday and Hasan a text is distinguishable from a disconnected sequence of sentences by the fact that in the case of the former a wide range of cohesive devices link the constituent parts together. The use of a reference item - such as 'it' or 'that', for instance - requires it to be co-interpreted in relation to another item, often preceding it. Such a relationship is considered semantic inasmuch as it involves interpretation or presupposition. And through such relationships is built up the semantically constituted unit 'text'. In the authors own words:

"If every text consisted of only one sentence, we should not need to go beyond the category of structure to explain the internal cohesiveness of a text: this could be explained simply as a function of its structure. But texts are usually not limited to one sentence .../A/ text typically extends beyond the range of structural relations, as these are normally conceived of. But texts cohere; so cohesion within a text - texture - depends on something other than structure... Our use of the term COHESION refers specifically to these non-structural text-forming relations." (p.7)

By treating cohesion as the set of meaning relations which create integrated texts, Halliday and Hasan sharply distinguish it from discourse. Whereas for Widdowson intersentential ties cannot of themselves account for the coherence of discourse, for Halliday and Hasan notions of discourse structure cannot in themselves account for

the 'texturedness' of text. Indeed, they adopt an altogether rather qualified approach to the whole question of discourse. They allow the possibility of setting up discourse structures and "specifying the structure of some entity such as a paragraph or topic unit. It is clear that there is structure here, at least in certain genres or registers."

"But" (they continue) "it is doubtful whether it is possible to demonstrate generalised structural ~~re-~~ relationships into which sentences enter as the realization of functions in some higher unit, as can be done for all the units below the sentence. This type of relation into which sentences enter with each other differs from that which holds among the part or sub-parts of a sentence... Whereas within the sentence, or any similar unit, we can specify a limited number of possible structures, such as types of modification or subordination, transitivity or modal structures and the like, which define the relations among the parts, we cannot in the same way list a possible set of structures for a text, with sentence classes to fill the structural roles. Instead we have to show how sentences, which are structurally independent of one another may be linked together through particular features of their interpretation; and it is for this that the concept of cohesion is required." (p.10)

In the same way therefore as Widdowson distinguishes 'coherence' from 'cohesion', Halliday and Hasan distinguish 'discourse' from 'cohesion'. In the case of the latter however the structural characteristics of discourse are emphasised in order to distinguish it from the relationships of interpretation and presupposition involved in cohesion. A polarity is again set up between two distinct modes of supra-syntactical organisation.

It is of course possible to sidestep this kind of distinction merely by arguing for an upward extension of syntax. An argument along these lines is advanced by Palek (1968) in a study of cross-reference. He views cross-reference as one crucial device for generating interconnected sentences in the form of a unified text. The interdependency of sentences in a text, however, must be achieved within the norms of the relevant language. These norms are given by the "particular structure of the language as an instrument of communication". (p.33). In the particular case of cross-reference, therefore, the identification and differentiation of denotates "must be structuralised in order at all to ensure communication" (p.33). Cross-reference is thereby seen as event of 'langue'. Structurally defined as an event of 'langue', Palek argues that cross-reference should be handled within syntax or - more precisely - that syntax should be upwardly extended beyond the sentence to include these 'hyper-syntactic' phenomenon.

The problem with this kind of argument is that it rests upon a loose definition of "langue" as 'norms' or 'patterning'. It could equally be used to justify treating phonology as a kind of sub-syntax. But just as the sound system of the language is modelled in different terms *from* that of syntax so would I wish to argue that patterning above the sentence (or equivalent syntactic category) be dealt with as a separate and different level of linguistic organisation.

One particular difficulty that emerges in both treatments of the distinction between coherence (or discourse analysis) and cohesion (or text analysis) is the scope and applicability of the notion 'sentence'. The following section addresses itself to this problem.

## 2.1. THE PROBLEM OF 'SENTENCE'

For Halliday and Hasan (as also for Widdowson) an important component of their approach to cohesion is the category 'sentence'. Structure accounts for the formation of sentences but not for the organisation of texts: "whereas within the sentence .... we can specify a limited number of possible structures ... we cannot in the same way list a set of possible structures for a text, with sentence classes to fill the structural roles". (p.10). Cohesion with its various devices of substitution, reference, eclipses etc. is therefore invoked to account, in semantic not structural terms, for the interrelationships between sentences.

This however leads them to the position of arguing that only those devices operating across sentence boundaries are intrinsically cohesive: within the sentence such devices are only a secondary source of texture. The primary source of texture within the sentence is the structure itself. Accordingly they state:

"As a general rule the examples cited in this book will be of cohesion across sentence boundaries, since here the effect is more striking and the meaning obvious: cohesive ties between sentences stand out more clearly because they are the ONLY source of texture, whereas within the sentence there are structural relations as well. In the description of a text, it is intersentence cohesion that is significant..." (p.9)

In studying extended passages of text, however, it seems clear that texture is created <sup>by</sup> the interplay of all the various cohesive devices irrespective of whether they are sentential or inter-sentential.

This is especially true of reference, substitution and lexical cohesion where chains or strings of items form through texts creating a continuous thread both within and between sentences. The following passage in which all the potentially cohesive devices have been marked may serve as an illustration:

"/now if you have a stem with separate vascular bundles like this .. (these) are on the same radius / not all . /incidentally/not all stems have (this) um . arrangement of separate vascular bundles. (these) are always taken (this) type of stem is always taken as the type for the herbaceous dichotolydenous stem the young herbaceous dichotolydenous stem but er . (it) only really represents about half . er of the di the dichotolydenous flowering plant kingdom because about an equal number of plants have . a continuous ring of phloem and a continuous ring of xylem on the inside . //and/why (this) is never brought out er . in er elementary courses I don't know because (this) is not necessarily representative of structure as a whole //but/ the rule about being on the same radius still holds good.

A.33/22-36

- / : 'sentence' boundary  
○ : demonstrative and pronominal reference  
▭ : conjunctive items  
— : lexical repetition.

In this example items such as 'stem', 'vascular bundle', 'type', 'dichotolydenous', 'plant', etc. form a continuous thread through the passage. If lexical repetition and reference items that operated only across sentence boundaries were noted, then an important source of texture would be overlooked.

A more fundamental problem however arises in deciding the exact domain of sentence structure. This becomes particularly difficult

when considering conjunctive items such as "and", "or", "but" etc. Such items are capable of fulfilling two different roles. In Halliday and Hasan's terms they can blend separate syntactic units into one integral syntactic structure or they can establish a logical connection between two separate sentences. They can operate as coordinate items or as conjunctive items. Halliday and Hasan distinguish these different roles in the following way:

"The typical context for a conjunctive and is one in which there is a total, or almost total, shift in the participants from one sentence to the next, and yet the two sentences are very definitely part of a text" (p.235)

This criterion may work adequately in the case of 'and' but seems less foolproof in the case of 'or'. It is possible to re-punctuate one of my own sentences from the preceding few lines as follows

"In Halliday and Hasan's terms they can blend separate syntactic units into one integral syntactic structure. Or, they can establish a logical connection between two separate sentences."

By the simple device of re-punctuation 'or' is transmuted from structural marker to logical signal. It may be bad style but it is difficult to establish its "ungrammaticalness".

Conversely conjunctive items which are never used structurally such as "nevertheless", "however", "accordingly" etc. commonly occur in written English after a colon or semi-colon. The problem is recognised by Halliday and Hasan in the following quotation:

"...as evidenced by the indeterminacy, or perhaps flexibility of our punctuation system, the sentence itself is a very indeterminate category, and it is



very common to find conjunctive adjuncts occurring in written English following a colon or semicolon. In terms of our definition of cohesion, if we take the orthographic sentence as it stands, such instances would not be cohesive, since cohesion is a relation between sentences, not a relation within the sentence."

(p.232)

The key difficulty here resides in defining the sentence orthographically and Halliday and Hasan later comment that written English

"has its own conventions, including that whereby the notion of a sentence (as written, i.e. extending from capital letter to full stop) is not bound by structural considerations, but takes in other factors as well - being exploited by many writers to reflect patterns of intonation." (p.233)

Strangely enough, however, they do not feel that problems of sentence definition pose themselves in relation to the spoken medium.

"In considering spoken English, we can define the sentence in such a way that this problem does not arise: If we say that a new sentence starts whenever there is no structural connection with what has gone before, then in all such instances there will be a sentence boundary before the conjunction." (p.233)

Since, however, items such as 'or', 'and' or 'but' can be either logical signal or structural marker it is not clear in many instances whether there is, or is not, "a structural connection with what has gone before". The notion of sentence therefore remains ill-defined. According to the above criteria the following example would be

divisible into at least three sentences, since each dotted stroke indicates the beginning of structurally independent unit.

"if you in fact look at this expression you'll find  
that the output voltage! I don't know what it is !  
I've not bothered to work it out ! but we'll say it  
does something that looks more like this /"

A.25/4-'7

And yet the example coheres as a whole. To make sense it has to be heard as saying:

"If you in fact look at this expression, you'll  
find that the output voltage - which I don't know  
since I've not worked it out - does something that  
looks more like this."

These kinds of considerations force us to the conclusion that sentence as a category is not relevant to the study of spoken text. Nonetheless in doing so, we still maintain our earlier claim that the text is easily partitioned into structurally or syntactically independent units. As clause-clusters rather than sentences however it seems clear, on the basis of the above example, that such units cohere together in the formation of larger wholes. Some principle of inter-clause cluster, must be at work. In the following section we examine particular examples from lecture monologue to examine what role the various cohesive devices might play in this integration. This examination then becomes the basis for substantially revising the distinction between cohesion and discourse in a later section.

### 3. COHESION

The taxonomy of cohesive devices drawn upon in this section is

broadly that of Halliday and Hasan since, although the broader theoretical implications of their work have been questioned, theirs is the most comprehensive description of specific cohesive devices to-date. Indeed some of the devices they discuss have not been included in this presentation since they are poorly represented in the data. Ellipsis for example rarely occurs in the data except as an aspect of branching where a necessary element of structure is ellided from a branched clause. It does not link one clause cluster with another and in general seems to be a feature of multiparty talk rather than monologue. Lexical cohesion has also been excluded not of course because it is poorly represented in the data. On the contrary the data is so rich in lexical repetition that problems arise in isolating its most significant aspects. Discussion of this form of cohesion is therefore postponed to the chapter on Intonation where it is seen as interacting with the prosodic parameter of tonicity.

Discounting lexical cohesion, the most prevalent forms of cohesive device in lecture monologues are considered to be: pre-eminently reference, some aspects of substitution, and a limited range of conjunctive items.

### 3.1. COHESION: REFERENCE

Reference items- such as for example 'it', 'they', 'this', 'these' 'that' etc. - "instead of being interpreted semantically in their own right, .... make reference to something else for their interpretation". (Halliday & Hasan p.31). They may either refer to the situation or to the another element in the text itself.

The lecture texts comprising the appendix were all in fact accompanied

by some form of visual display. Consequently a significant proportion of all reference items refer to details of the accompanying display. Demonstrative reference items in the following examples are all of this type.

"/now if you have a stem with separate vascular bundles like this . and so on (1) /just show xylem and phloem for simplicity xylem here phloem towards the outside/ these are on the same radius /

A.33/22-25

"/these are the signals we have to deal with most/ and in fact since you can take a periodic wave form such as this or this or this and break it down into its component sinusoids..."

A.18/35-38

Insofar as such items refer outwards from the text to the visual display it may be argued that they are non-cohesive : they do not knit one part of the text together with another. In lectures however the text is to some extent more than the delivered monologue. The visual display functions as a kind of sub-text or supportive accompaniment to the unfolding speech. In so far as blackboard work or diagram helps shape and constrains the unfolding monologue, it is itself 'cohesive' in a broad sense.

While noting the presence of this kind of item we have however, for ease of interpretation, restricted the following examples of reference to those which explicitly and directly link one part of the verbal text with another.

### 3.1.1. PERSONAL REFERENCE

The most common kind of personal reference items used cohesively

in lecture monologue are in fact the non-human pronouns 'it' and 'they'.

IT - reference.

We distinguish between two types of 'it'- reference. Frequently the referent for 'it' (used either as Head in a nominal group or as Modifier with a possessive function) is recoverable directly in the form of a nominal group from the immediately preceding text. In the following example both reference item and referent are underlined:

- 3.1 Ex.1       "/and these lateral branches will reproduce the structure of the main stem/that er axillary bud there develops/it will produce its own stem with leaves and axillary buds and a terminal bud/".

A.34/27-30

It is also common however for 'it' - reference to involve more extended passages of text or referents that are derivable from the text only by paraphrase, as in the following two examples.

- 3.1. Ex.2       "/now amplifiers of course can perform a number of different functions/they can amplify what are essentially steady voltages or currents - sometimes and rather unfortunately called DC amplifiers - direct current amplifiers - what it means is its amplifying a steady voltage/or we might amplify a small but time varying voltage/it needn't necessarily be a periodic wave form/".

A.18/16-21

- 3.1. Ex.3       "/to say it's an alternating current voltage - an AC voltage - as so many people do of course is a bit of a nonsense/um we all do it I'm afraid so I'm going to have to use this rather loose terminology/".

A.19/17-20

In the first of these examples 'it' refers to what might be paraphrased as 'that which is amplified'. In the second example 'it' denotes a portion of text, viz. "say it's an alternating current voltage".

THEY - reference.

In conjunction with 'it', 'they' accounts for about half the instances of anaphoric reference in lecture monologues. Some examples are as follows:

- 3.1. Ex.4    "/a number system consists of a set of elements/let's think of integers/they're the elements one, two, three, four, five, six, seven, so on/"

A.8/12-14

- 3.1. Ex.5    "/these er structures are characterised by having er relatively long erm stalks which are more or less um circular in cross section/and then on the top they have a head which er is somewhat elliptical/it varies actually in shape/"

A.38/17-21

- 3.1. Ex.6    "/usually the filaments are not terribly rigid/they're rather thin/"

A.41/33-34

Unlike 'it', 'they' typically refers only to explicitly identifiable referents clearly represented in a previous nominal group.

### 3.2.2. DEMONSTRATIVE REFERENCE

Various distinctions may be noted concerning the operation of demonstrative reference such as 'near' v 'far' (i.e. 'this' v 'that') of 'singular' v 'plural' (e.g. this v these) or Modifier v Head (i.e. "this structure" v plain "this").

In lectures, none of these distinctions seems as important as that made earlier in the context of 'it' - reference.

In some cases the referent for the demonstrative is supplied in the text in the form of <sup>a</sup> clearly identifiable nominal group, as in

the following:

3.1.Ex.7 /but first of all er I want to be sure that you all have met the three words commutative, commutative, associative and distributive/ how many people have heard those words and know what they mean/

A.8/4-7

3.1.Ex.8 "/we find that the flower is built up upon the basis of . er this structure here which I've shown as erm . er as a sort of dilating axis rounded at the tip/and here again there are many variations/ and er we'll come onto those er later on/"

A.35/30-33

In other cases however the referent of the reference item is supplied by a process or phenomenon presupposed in the previous text or indeed by a portion of the text itself.

3.1.Ex.9 "/in other words we have one sort of globular structure at the base there and then a number of separate stalks projections out of the top like that/now that's rather suggestive."

A.39/12-15

3.1.Ex.10 "all we have to know is what the device does not how it does it/and this is important because as time goes by more and more devices come onto the market/"

A.29/9-10

3.1.Ex.11 "you write as the top row of the matrix 'a one one, a one two, a one three' up to 'a one n'/second row 'a two one' up to 'a two n' and so on till the nth row is 'a n one, a n two' up to a 'a n n'/there are n squared elements/ and er that's the way they go/"

A.4/18-21

3.1.Ex.12 "/right . so . all we do then is change the label 'i' wherever it occurs/it's the first suffix on 'a' and the suffix on 'b'/so it's 'a two one, x one plus a two two, x two equals b two/right/ and that's the answer/"

A.7/5-8

In this respect 'that' is even more flexible than the personal pronoun 'it' inasmuch as it can refer to extremely lengthy passages of text. Extended demonstrative reference of this type often occurs at boundaries in the text signalled by some kind of metastatement, as in the following:

- 3.1.Ex.13 /now I think that's as much as we need to say er for your purposes regarding the structure and anatomy of the flowering plant .../"

A.34/16-18

- 3.1.Ex.14 "/and that all sounds rather complicated/forget about those last two definitions but note them down/"

A.5/5-6

- 3.1.Ex.15 "/well now this is not the end of the er general structure of the flower"

A.37-38/38-1

Extended text reference of the demonstrative type occasionally operates both anaphorically and cataphorically at the same time. In such cases 'this' rather than 'that' is usually selected as in the following examples.

- 3.1.Ex.16 "/and in amplifier design we want to keep the amount of distortion to an absolute minimum/but this is essentially the problem/it's in using our various devices in such a way that we minimise this distortion/"

A.25/22-25

- 3.1.Ex.17 "/if you add to that a smaller signal only a third the amplitude of 3f and then 5f and 7f you actually build up this square wave/nw this is true/any periodic wave form can be broken down into a number of component sin waves of different frequencies/"

A.19/1-5

- 3.1.Ex.18 "we don't have to consider the physics of the device/this is the important thing/we don't have to consider the exact way the transistor works/"

A.28/36-38



The foregoing use of 'this' and 'that' to carry forward through the discourse some portion of the previous text or some process represented by the previous text is a key form of cohesion in science lectures and indeed in much spoken discourse. Halliday and Hasan comment that this use of the demonstrative together with the related use of 'it' is "one of the major cohesive devices of the English language" (p.67). They add that "Spoken English is typically held together by internal cross-referencing of this kind, which combines powerful structure with great flexibility and freedom of movement" (p.67).

Extended or text reference of this kind is usually realised by a demonstrative operating as Head. There are examples however of demonstratives modifying a Head word which is either a superordinate term for items mentioned in the previous discourse or a "meta"-term which serves to specify more precisely that portion of the previous text which is being referred to. Demonstrative reference of this type can be either "near" or "not near", neither selection being the marked form.

these organs A.33/7  
these two conditions A.34/12  
these structures A.36/16  
these um . cases A.37/19  
these er . organs A.38/7  
these er . structures A.39/29-30  
these um . organs A.38/25  
these er organs A.38/29  
these organs A.39/2  
that feature A.41/27  
in this . central region.of each of these groups A.42/32  
  
this definition A.4/8  
those last two definitions A.5/26  
all these equations in the suffix notation A.5/30  
one example of that sort A.6/4  
the important equation of this sort A.6/4  
all this complicated i's and j's business A.7/9  
this basic setting up of a whole new notation in mathematics.  
A.7/37-8  
  
these definitions A.8/3  
those words A.8/7

those two operations A.8/16-17  
these properties A.9/9-10  
this rather abstract approach A.9/29  
that situation A.11/18  
that choice A.11/20  
this method A.12/2  
this game A.11/37  
this procedure A.13/1  
this problem A.13/15  
that confusion A.13/37  
that stuff A.15/1  
all these things A.15/4-5

that particular aspect of analogue circuit design  
A.18/13-14  
this rather loose terminology A.19/20  
those components A.19/29-30  
this relationship A.24/33  
this process A.27/35  
those two situations A.28/18  
this sort of argument A.28/20  
that term A.28/28  
this process A.29/8  
this problem A.30/5  
these maximum ratings A.30/25

The terms listed as Head in the above examples either stand in a natural hyponomic relation to items of the previous discourse ('organs' for instance has an inclusive relation with respect to 'root', 'stem' and 'steele'; and 'components' has a similar relation to 'transistors', 'inductors' and 'capacitors'); or, they operate at a meta level in referring to the discourse itself (as in 'example', 'definition', 'argument'). In whichever role, it would appear that some part or item of the previous discourse is presupposed in their interpretation or, at least, is required for a fuller interpretation. Accordingly they operate like reference items themselves, especially if we bear in mind Halliday and Hasan's comment that,

"we can summarise the meaning of reference by using the term CO-INTERPRETATION. There is a semantic link between the reference item and that which it presupposes ... A reference item is one which is interpreted by reference to something else" (p.314)

In this respect the superordinate terms such as "components" or "organs" are similar in purpose to items such as "definition", or "example". Indeed Winter (1976 ms.) has argued that items such as "feature", "method", "problem", "situation", "structure", "condition" fall within a closed set of lexical items which require lexical realisation elsewhere in the text. Accordingly, insofar as they point not so much towards the world but to the text itself they can thus be regarded in his phrase as "a natural metalanguage for the open system words". (p.125 ms). The use of the demonstrative as Modifier to these items operating as Head can be seen as an explicit signal to recover their lexical realisation from the previous discourse while the item itself can be seen as carrying forward through the text some given information in a generalised form. In lecture discourse it should be noted that they normally operate retrospectively rather than prospectively (although some exceptions will be noted in Ch.IV) and their use is somewhat complicated by the frequency with which they refer not so much to the verbal text but to the visual sub-text. In the latter case it is the diagrams and figures which supply the referents and also, by analogy, the 'lexical realisation' of abstract, superordinate or metalinguistic terms.

### 3.2 COHESION : SUBSTITUTION

Substitution is the replacement of one item by another. Halliday and Hasan distinguish it from reference by saying that "substitution is a relation between linguistic items, such as words or phrases; whereas reference is a relation between meanings. In terms of the linguistic system, reference is a relation on the semantic level,

whereas substitution is a relation on the lexicogrammatical level, the level of grammar and vocabulary, or linguistic 'form' "A substitute is a sort of counter which is used in place of the repetition of a particular item."

Substitution of clauses by 'so' or verbal groups by 'do' is not a common feature of the lecture texts appended. Substitution of nominal groups by 'one' or 'some' is more common.

Nominal substitution - "one", "some":

Most frequently nominal substitution occurs within the clause cluster itself, as in the following examples.

3.2.Ex.1     "/as you go round a ring of petals you may have large ones and smaller ones alternating in a ring but the overall effect is a radial symmetry/"

A.40/27-29

3.2.Ex.2     "/er the view we get rather depends on the state of development of the anther as to whether it's a young one being formed in the bud or whether it is a mature one or even a moribund one in an open flower"

A.42/13-16

Within the context of this discussion such instances do not play a direct role in supra-syntactical organisation. It is, however, worth pointing out this type of occurrence insofar as it indicates a tendency for nominal substitution to be a short-domain form of cohesion.

The following examples show either 'one' or 'some' operating between clause-clusters.

3.2.Ex.3     "/these are the common or garden transistors/these are the ones that were first produced in the fifties/"

A.20/9-10

- 3.2.Ex.4     "/so a perianth may be distinguished quite easily into sepals and petals . or . er . two may not be capable of being distinguished except on the basis of position ./the lower ones . er . could probably be called the calyx/"

A.37/22-25

- 3.2.Ex.5     "/there's the passive circuit - two terminal, four terminal - with an input and an output/and there are some called active networks/and these are the ones that we're interested in/"

A.27/4-7

One interesting feature of substitution is that usually the substitute carries over only the Head of the previous nominal group and does not carry with it the modifying elements of the previous context. Its function can be seen as taking a noun from one context of modification and placing it in a new one by means of a substitute counter. In the last example above, for instance, the use of 'some' enables "passive circuits" to be contrasted with "active networks". Halliday and Hasan use the term REPUDIATION to describe this activity of the substitute and explain the notion as follows:

"In any anaphoric context, something is carried over from a previous instance. What is carried over may be the whole of what there was, or it may be only a part of it; and if it is only a part of it, then the remainder, that which is not carried over, has to be REPUDIATED. ... Semantically this means that given the set of things designated in the original instance, what is now being designated is in some sense a new subset." (p.93)

This process is one aspect of a prevailing feature in lecture texts whereby meanings are progressively modified as the text unfolds, a feature that will be further elaborated in ch.IV. For the moment we can draw a parallel with multiparty discourse concerning which it can be argued that it consists of an elaborate negotiation of

meaning between parties. In lecture monologue progressive modification of meaning takes place within the speech of the one active participant in the speech event.

An essential difference emerges here between reference and substitution. The former implies semantic identity between the reference item and that which it presupposes. The latter often implies some redefinition and involves a point of contrast.

### 3.3 COHESION : CONJUNCTION

Halliday and Hasan distinguish four main types of conjunctive relationship : the additive, the adversative, the causal, and the temporal. Items such as 'and', 'yet', 'so' and 'then' may be considered prototypical exponents of the four main relationships, respectively. Further differentiations may be made within each of the four major relationships. The basic additive relationship, for instance, also includes the relationship of 'expository opposition' ('that is', 'I mean', 'in other words') - a common mode of relating independent syntactic units in lectures. Such finer distinctions will be introduced as they become necessary.

#### 3.3.1 ADDITIVE

AND: (Simple additive)

This is the most common conjunctive item in lecture monologue and can occur as frequently as 60 times in one 1 hour lecture, a feature which gives rise to such passages as the following (both the

conjunctive item and the domain under its influence are underlined):

- 3.3.Ex.1     "/now er I mentioned that in most cases the corolla is large and coloured sometimes assisted or replaced by the sepals/and this is in connection er with the reproductive process because a great number of flowers er depend er upon insects flying insects er for the process which we call pollination which we'll come on to later on/what pollen is and how it works and so forth we'll deal with in a subsequent lecture/but er conveyance of pollen from one flower to another is an essential part of the reproductive process/ and this very often is brought about through the agency of flying insects such as er bees butterflies and so forth/and the er bright colour of the er perianth particularly of the corolla is looked upon as one of the features serving to attract er suitable insects to the flower/

A.37/25-38

The item 'and' rarely links any more than immediately adjacent clause clusters though one exception to the rule may be noted in the following example.

- 3.3.Ex.2     "/flowering plants are of two main kinds/(2) there are those which complete their life cycle in a single year - a single growing season/(3) and these are what we call annuals/ 3 sec pause7(4) and there are those which are which go on from year to year producing flowers each year. and increasing in er size these are what we call perennials/

A.35/14-19

(Syntactically independent units are numbered from (1) to (5).)

In this example the additive 'and' that introduces the fourth syntactically independent unit actually operates like a pivot around which the whole section turns. One explanation for this unusual use of 'and' lies in the presence in the opening clause cluster of the phrase "two main kinds". In the account of reference given above it was noted that such general noun phrases containing a

hyponomic or superordinate term as Head normally operate retro-spectively. In this case however the phrase occurs without the demonstrative and is prospectively oriented to set up a prediction that 'one kind of flowering plant' will be matched with another.\*<sup>1</sup> In so doing it 'cues in the listener', as it were, to hear the initial 'and' in the fourth unit as a higher order additive than the other two 'ands' in the example. In this respect the listener is aided by the overall syntactic and lexical parallelism whereby unit (3), for instance, parallels unit (5).

OR: (simple additive; alternative.)

OR occurs much less frequently than 'and' and appears to have two separate roles in suprasyntactical organisation. It may merely link immediately adjacent syntactically independent units or it may fulfil a higher order function. Examples of the first type of role are as follows:

3.3.Ex.4    /so a perianth may be distinguished quite easily  
              into sepals and petals/or . er . the two may not  
              er be capable of being distinguished er except  
              on the basis of position/

A.37/22-24

3.3.Ex.5    "/it may be a motor . if we're trying to produce  
              movement . /or . it may represent the input . of  
              the of the next stage/"

A.23/9-10

3.3.Ex.6    "/it may be motor driven/or may be you turn  
              it with your hand/

A.24/13-14

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\*<sup>1</sup> The notion that certain items can predictively organise clauses to display a matching relationship is drawn directly from Winter (1976 ms.). The predictive role of such items is further discussed in ch.IV below.



3.3.Ex.7    "/it may have two terminals./or in fact it  
              may have four terminals . shown here ./

A.27/8-A28/1

However, 'or' is also used commonly in a higher order role involving more than immediately adjacent syntactically independent units, as in the following.

3.3.Ex.8    /now amplifiers of course can perform a number  
              of different functions . /they can amplify.  
              what are essentially steady voltages or currents .  
              sometimes and rather . unfortunately called  
              D.C. amplifiers direct current amplifiers /  
              what it means is its amplifying a steady voltage .  
              /or . we might amplify a small but time-varying  
              voltage . /

A.18/16-20

In this example 'or' links the final unit not so much with the preceding one but with the second unit in the example. In some respects it signals the resumption of the discourse after an paren-  
thetic remark ("what it means is ..."). Its role in this context is anticipated by the phrase "a number of different functions" at the beginning of the example, a phrase which requires lexical realisation insofar as it anticipates further information to follow. And the use of "different" implies some kind of ensuing matching relationship. The 'higher order role' of 'or' is thus prepared for in advance.

THAT IS ; I MEAN ; IN OTHER WORDS. (Additive : expository apposition).

This variation of the additive relation is almost as common as the simple additive 'and' itself. Some examples are given below:

3.3.Ex.9    "/its  $i$ jth element is simply the complex conjugate  
              of  $a_{ij}$ / in other words you just take every element  
              in the matrix and take its complex conjugate/"

A.5/17-19

- 3.3.Ex.10    "/now amplifiers of course can perform a number of different functions/they can amplify what are essentially steady voltages or currents sometimes and rather unfortunately called DC amplifiers direct current amplifiers/what it means is its amplifying a steady voltage/or we might amplify a small but time varying voltage/"

A.18/16-20

In these instances the expository apposition item links immediately adjacent units and the unit prefaced by the item has an parenthetic status. This would appear to be the norm for such items. There are however occasional instances of such items organising longer sections comprising more than two adjacent syntactically independent units as in the following example.

- 3.3.Ex.11    "/er in the root the protoxylem is out here/in the stem the protoxylem (this is the inside of the stem) the protoxylem will be found here/so in other words in the root the protoxylem is on the outside and the xylem subsequent xylem forms inwards/ in the stem the protoxylem is on the inside and the subsequent xylem metaxylem and so forth is produced outwards./"

A.34/6-11

This example is distinctive inasmuch as the item 'in other words' links the two units which precede it with the two units that follow it. However in this instance the expository apposition item operates in collaboration with a further important conjunction - 'so'. (It is also noticeable that 3 lines above in the transcript occurs another anticipatory phrase: "now another important point which arises is the position of protoxylem: ...") The norm would therefore appear to be that expository apposition items indicate a close relationship between immediately adjacent and syntactically independent units unless a further conjunctive item signals otherwise.

A further feature of expository apposition is that the relationship may occur without being signalled by an explicit conjunctive item as in the following example.

3.3.Ex.12    "/and er these er buds in general have the  
              characteristic of indefinite growth/once they  
              begin to develop they go on and on/"

A.34/32-33

In this case the relationship of the second unit to the first could be made explicit by inserting such a phrase as 'in other words' between the two. In ch IV the role of intonation in signalling the relationship in the absence of an explicit conjunctive will be discussed.

SIMILARLY ; LIKEWISE ; IN THE SAME WAY. (Additive, comparative)

In this kind of additive relation the source of cohesion is the comparison of what is being said with what has gone before. According to Halliday and Hasan these forms

"are used by the speaker to assert that a point is being reinforced or a new one added to the same effect; the relevance of the presupposing sentence is its similarity of import to the presupposed one. There may be likeness in the event; the cohesive use of comparison does not exclude the presence of an external component . . . but essentially it is the similarity in the context of the communication process that is being used with cohesive effect." (p.247)

This kind of additive relation is infrequent in lectures unless implied through structural parallelism (to be treated in a later section). The converse of similar additive relation ('on the other hand', 'by contrast' etc.) seems totally absent from the data.

Moreover the explicit markers of similarity seem different from other conjunctive devices inasmuch as they tend to extend their domain forwards and backwards over a greater portion of the text. In the following examples the anaphoric span of the conjunctive can be two or three clauses. They tend to function as a kind of organising pivot around which, we find a cluster of six or seven clauses.

- 3.3.Ex.13 "and the first point that we noticed was that um in the root we have er a narrow steele strength-  
ening material in the centre of the root/in the  
stem much more superficial/and remember that  
this was related to the forces the main forces  
acting upon er these organs/er in the same way  
if the steele is er narrow then the cortex in  
the root will be wide/in the stem if the steele  
is wide . then the cortex will be narrow.

A.33/3-9

- 3.3.Ex.14 "/if they are fused together to any extent er then  
we refer to them as being gamosepalous/and er  
a synonym of gamosepalous is synpetalous er  
synsepalous/but er gamosepalous is the normal  
one/er likewise in connection with the um corolla  
we have er polypetalous and normally synpetalous/"

A.40/4-9

- 3.3.Ex.15 "/now these input quantities these input voltages  
as I said can be steady voltages as in our example  
here plus three minus two/these are steady voltages  
not changing with time/these are our so-called DC  
inputs the steady input voltage/equally well they  
could be some form of time varying signal - either a  
periodically time varying signal or not/they don't  
have to be periodic/"

A.22/9-16

- 3.3.Ex.16 "/I can insert the voltage either on that terminal  
or on that terminal/ and depending on which one I  
use it will either invert or not invert the polarity  
of the input voltage/I could equally well of course  
feed a voltage to both terminals simultaneously/"

A.21/27-31

FOR INSTANCE ; FOR EXAMPLE ; THUS. (Additive; exemplification)

In broad terms we can see many science lectures displaying a form of reasoning which involves proceeding from the abstract principle to the particular example or vice versa from concrete instance to general statement. It is a curious fact that notwithstanding this interplay between deductive and inductive thought there are very few instances of explicit exemplificatory conjunctive items in the texts. We can find only one clear instance of this kind of item which we record below.

3.3.Ex.17 //um another thing that we want is to say that the amplifier has a low . intermodulation . performance . /say for instance we . feed our amplifier from two signal sources simultaneously . one oscillator . an oscillator there . and an oscillator there . and an oscillator there . with respect to earth/ now we can choose the amplitude of the signals we feed in from these two oscillators and we can also choose the frequency/thus we can feed this into the amplifier with a frequency F1 and this with a frequency F2/ and what we should get at the output is an amplified version of this signal added to that signal/"

A.25/25-34

If however we find a dearth of particular conjunctive items such as 'for example', there are on the other hand frequent references to 'example', 'illustration', 'exemplify' etc. These vary in frequency from lecture to lecture being most common in the mathematical lecture. In this lecture we find utterances such as the following:

3.3.Ex.18 /er those were examples/I'll now get down to the examples in more detail as to how the two notations er relate to one another/

A.3/12-14

- 3.3.Ex.19 /Right/er . I will simply work one example of that sort/but I'll remind you first of the summation convention/

A.5/33-35

- 3.3.Ex.20 /Right/so . I will write down perhaps the most er the important equation of this sort which isn't actually explicitly there so that I can do it as an example/

A.6/3-5

- 3.3.Ex.21 /when you set up a number (and we'll be coming back to deal with fundamental things like that in a bit later er after we've dealt with this specific example which will be useful to illustrate the general points) a number system consists of a set of elements.

A.8/9-13

- 3.3.Ex.22 /right/so I'm going to an example illustrating how we use this method/you will see the the general method I think better by an illustration/

A.10/24-26

These are not so much conjunctive items relating one clause or sentence to another as signposts to the interpretation of large portions of text. (In the mathematics lecture their function is complicated by their tendency to refer to blackboard calculations and thereby to the sub-text rather than the text itself. Blackboard work however reflects back on the ensuing and attendant formation of the text itself). Thus, while items such as 'for example' can initially be treated as conjunctive and therefore cohesive, as the domain of the exemplificatory semantics increases in span it would seem more appropriate to consider them from the point of view of discourse as well.

INCIDENTALLY ; BY THE WAY (Complex additive : de-emphatic).

In lectures, items such as 'incidentally' serve to mark units

which depart from the central topical drift of the discourse. In this sense AFTERTHOUGHT is perhaps something of a misnomer suggesting as it does something added at the end of a stretch of discourse. In lecture monologue, units prefaced by 'incidentally' are often inserted in the discourse and have similar status to what can loosely be defined as an 'aside'. Here again the domain of the text dominated by the item can be much larger in extent than one or two clauses. Accordingly the increased domain of the item once again raises the issue of the point at which cohesion shades into discourse organisation. The lengthy nature of the examples listed below provides an illustration of this point.

3.3.Ex.23   "/now if you have a stem with separate vascular bundles like this . and so on (1)/that shows xylem and phloem for simplicity xylem here phloem towards the outside ./these are on the same radius/(1) er not all incidentally not all stems have this um . arrangement of separate vascular bundles ./these are always taken this type of stem is always taken as the type for the herbaceous dicotyledonous stem the young herbaceous type dicotyledonous stem/um but er . it only really represents about half (1) er of the di the dicotyledonous flowering plant kingdom because about an equal number of plants have (1) a continuous ring of phloem on the outside and a continuous ring of xylem on the inside (1)/ and er why this is never brought out . er . in er elementary courses I don't know because this is not necessarily representative of structure as a whole/but the rule about being on the same radius still holds good./"

A.33/22-36

3.3.Ex.24   "/with the feature . incidentally . often goes . er a considerable (1)er length . of filament (1) longer filaments . so that the anthers (1) are not confined . within . the corolla and so forth . but are way up . er above the flower (1)/this again . is a good thing . from the point of view of er the wind picking up . the pollen (3)/the anthers are up in the air and can readily be caught . by the wind (1)/"

A.41/26-32

AND ANOTHER THING (complex additive : emphatic)

This kind of item rarely has a short domain role but usually serves to punctuate quite extended passages of text, as in the following examples:

- 3.3.Ex.25 /you don't get the anthers fusing together .  
only the filaments /and here again the degree  
of fusion can vary (2)/you may have . the  
filaments all fused together . so that you  
have . a sort of androecium tube . with the  
anthers . er around the the top (13 sec. pause)  
//now I mentioned ...

A.41/4-8

- 3.3.Ex.26 /the anthers are up in the air and can be  
readily caught by the wind (1)/another thing  
again . in such flowers . usually the fila-  
ments are not terribly rigid/they're rather  
thin/ and this all helps the . er stamens to  
wave about and er . cause the pollen to  
become airborne (2)/.

A.41/31-35

- 3.3.Ex.27 (3)/um . another thing that we want is to say  
that the amplifier has . a low intermodulation  
performance (7)/

A.25/25-27

Over and beyond linking syntactically independent units this kind of item seems to be associated with indicating topical shift in the discourse.

We can summarise the main types of conjunctive relations of the ADDITIVE type found in lectures as follows:

Additive : "and"

Alternative: "or"

Complex additive relations (internal): emphatic

Additive: "and another thing"



Complex additive relations (internal): de-emphatic

Afterthought: "incidentally"

Comparative relations (internal)

Similar: "likewise", "similarly"

Appositive relations (internal)

Expository: "that is", "I mean", "in other words"

### 3.3.2 ADVERSATIVE

Typical conjunctive items expressing the adversative relation between units such as clause or sentence are "yet", "but", "however", "nevertheless". The underlying meaning is thus in the area of 'contrary to expectation'. Halliday and Hasan distinguish between "yet" and "but" on the grounds that "but" contains an "and" element of meaning whereas "yet" does not. "Yet", however, does not appear in the data and so the typical exponent of the adversative relation in <sup>these</sup> lectures is "but". This, like the additive items, suggests 'there is something more to be said' but also implies that what is added in some way limits or contradicts what has gone before.

BUT. Some examples of the prevalent use of "but" are given below:

3.3.Ex.28 "/I have to say that that that even this definition . doesn't er remove all confusion because . the . the word rank is used in mathematics for for other things (1)/but that's our definition of it in this context/.

A.4/7-10

3.3.Ex.29 "/that's a completely arbitrary choice/but its one that's as well to make/

A.4/27-28

3.3.Ex.30 "/I will call them a/but I'll try and avoid that for confusion because er it will generate confusion/

A.8/18-19

- 3.3.Ex.31 "/I hope I've cooked this so the numbers come out reasonably nicely/but please don't look at it and say oh we must just try a few things . because the real world is not like that/"

A.10/33-36

- 3.3.Ex.32 "/the power supply is really the source/but it is very convenient from the point of view of analysing what goes on in these circuits to say that it's the transistor that's the source/ it makes for simpler understanding of circuits./"

A.28/2-6

- 3.3.Ex.33 "in reality the transistor on its own is a purely passive device/it does not contain any sources/but when we put it into circuit it's very convenient to say it suddenly becomes an active device/"

A.28/21-24

One further function of 'but' is to resume the former direction of the monologue after an aside or a digression. We see this function in the examples below.

- 3.3.Ex.34 "/if we move up slightly up the receptacle we come to another . group of er organs which normally - often have to use this word normally - are larger than the sepals/(1) sometimes they're of the same shape ./and er there's really little point in putting up er another drawing equivalent to the calyx drawing . showing the form . of the er erm of the next type of organ ./er this sort of shape would be quite typical for one of them (1) but they're usually much larger than the um (2) sepals (3)."

A.36-37/33-2

- 3.3.Ex.35 "/these er structures . are characterised by having (2) er relatively long . erm stalks (1) which are more or less um . circular in cross section ./ and then on the top . they have a head . which is somewhat elliptical ./ it varies actually in shape/. er it is not . circular in cross section/ that is in that direction it tends to be lobed./ and that's why I've drawn a line down there (3)/ we'll um when we come to the er practical er this afternoon and er on Monday . we'll be looking . at er er an example of a flower maybe actually seeing . these um organs ./but er. these things then have a stalk"

A.38/17 - 26

The problem of deciding the exact status, scope and extent of asides will be dealt with more fully in the next chapter. The resumptive 'but', however, tends to recast a preceding piece of text into an aside or digression by repetition and lexical items from the clause prior to the aside. In 3.3. Ex.34 "larger than the sepals" is repeated and in 3.3. Ex.35 "these" "have" and "stalk" are repeated.

This resumptive use of 'but' overlaps with what Halliday and Hasan term the 'emphatic adversative' relationship signalled by such items as 'however' or 'nevertheless'. In the following example 'nevertheless' would seem identical in function to the "resumptive" use of 'but' noted above.

3.3.Ex.36    "/and er these er buds . in general . have the  
characteristic of . indefinite growth /once they  
begin to develop they go on and on (1) /of  
course for various reasons . a particular plant  
according to conditions . erm individual buds  
may remain dormant for long period /nevertheless  
they . have the . capacity for indefinite growth./"  
A.34/32-36

As in the previous two examples, the last unit of this example repeats portions of the opening unit.

IN FACT : ACTUALLY (Avowal Contrastive Adversative).

In contrast to 'but', 'however' or 'nevertheless', the so-called avowal contrastive adversatives almost invariably relate only two immediately adjacent syntactically independent units. Furthermore, as with items such as 'that is' or 'in other words', they quite often preface what may be heard as a parenthetic statement. Some examples are cited below:

3.3.Ex.37 "er we have various categories of organs .  
which can be looked upon . as um . modified  
leaves modified in connection with reproduc-  
tion (1) /erm there are er varying views  
actually on this matter/but er we won't go  
into that/"

A.36/5-8

3.3.Ex.38 "the rank (3) of . an array (3) is the  
number of suffices (2) /I should actually  
be more precise . free suffices/"

A.4/4-5

3.3.Ex.39 "if we had written down columns . a one one  
a one two and so on . a one n going downwards  
a two one a two two and so on we would have  
generated the transpose matrix /(2) its  
called transpose actually because if you  
draw that diagonal line through the matrix .  
and just flip the thing over you arrive at  
the transpose matrix/"

A.5/5-10

Although the norm for avowal contrastive adversatives is to relate short segments of text they may however play a role in punctuating more extended passages of discourse. In such cases the presence of another item (such as 'now' for example) signals its changed role. The following examples are of this type.

3.3.Ex.40 "now if we in fact measure the produce of the  
input that gives us the input power/"

A.22/29-21

3.3.Ex.41 "now this load may in fact be simply as I've  
shown here a physical resistance/"

A.23/6-7

3.3.Ex.42 "now if in fact the output voltage differs  
from the input control then we say we've  
introduced distortion/"

A.25/27-19

In contrast to the short domain avowal adversative these examples are non-parenthetic.

### 3.3.3 CAUSAL CONJUNCTION

SO: This item appears to be a blanket term in science lectures for the various causal relations. It occurs with great frequency (more than forty times in one lecture) and with a variety of functions.

Specific uses: result.

3.3.Ex.43    "/and for the third equation we're going to  
add plus two to that/so we get nought nought/"  
A.12/31-32

3.3.Ex.44    "/every element is swapped . with the one on  
the opposite side of the diagonal /(2) so that  
swaps with that a n a n one /that's the  
operation of the transposition/"  
A.5/10-12

3.3.Ex.45    "/now if its a good amplifier it will have  
both voltage gain and current gain /so V-out  
will be much larger than V-in and I-out will  
be much larger than I-in/"  
A.22/27-29

Reason: (it follows; for this reason)

3.3.Ex.46    "/as we were all told, we couldn't add sheep  
to goats or apples or oranges /so we must not  
add x's to y's at this stage/"  
A.11/14-15

Purpose: (with this in mind)

3.3.Ex.47    "/but . we have to write this equation down  
for all the values of i /so let's label the  
equation by i where i equals one and i equals  
two/"  
A.6/28-30

These are what might be termed specific uses of "so". Their common characteristic is that they tend to operate conjunctively between two adjacent clauses. In each case they are also susceptible to one or other of the specific paraphrases suggested in brackets

above. Sometimes more than one paraphrase would suit a particular example but this does not seem to detract from their specific character.

SO: General.

While the foregoing examples of 'so' have been susceptible to specific paraphrases in terms of reason, result and purpose, there are however many examples of 'so' fulfilling a more general function. In the latter case a more general causal relationship is imputed on the basis of an extended passage of text.

In the examples below we can distinguish two main kinds: 'so' marking a summary of an extended passage of text; and 'so' indicating a return to the main thread of the discourse. Here again we have to note that this distinction points up tendencies and is not absolute: some instances tend to embody both functions.

SO: (summary) :

3.3.Ex.48    "/now the stalk of each stamen . is referred to as the filament (8) /and the head of each stamen is referred to as the anther (5) /so . anther and filament bracket together as stamen (5) /now ... /"

A.38/31-33

3.3.Ex.49    "/er (1) in the same way if the steele is er narrow then the cortex in the root will be wide . /in the stem if the steele is wide then the cortex will be narrow . /and related to these forces which act remember that in the stem you also have very often this layer of collendima (1) cells thickened at the corners . /and these are just under the epidermis /so once again strengthening material . um . near the surface of the organ (1) /now another .../"

A.33/7-14

3.3.Ex.50    "/I shall be concentrating mainly on amplifiers for amplifying sinusoidal signals . AC signals . alternating current / ... /so we shall be dealing with small signal and large signal AC amplifiers and amplifiers of steady voltages -DC amplifiers /now an amplifier ... /"

A.19/15-17. 22-24

3.3.Ex.51    "/and we can define immediately two properties of this amplifier /.../and so our general amplifier will have two properties - a voltage gain and a current gain / now there are .../"

A.20/25-26,  
A.21/9-10

3.3.Ex.52    "/so . I'll leave you with the thought that not only have you got to get the . to use the appropriate model for the application /get your design out /you've also got to select your components so that they'll do the job that you want them to /will do it reliably and as cheaply as possible (3) /right . we'll stop there .../"

A.30-31/34-1

This last example is perhaps the clearest instance of 'so' used to introduce a summary. It comes at the end of a lecture and prefaces what amounts to a recapitulation of the final half of the preceding discourse. It also illustrates one of the problems in isolating the retrospective domain of influence of these items insofar as they can extend back to include a large portion of the total lecture.

SO (resumptive):

These often occur following 'right' and indicate a return to a preceding thread in the discourse. Since it is usually very difficult to identify precisely the point in the text to which they refer back to it is best to interpret their function as prospective: they signal a new beginning which nevertheless is intended to be heard as in some way causally related to some thread in the previous discourse.

3.3.Ex.53    "/they of course work in the most economical way ... which uses a method called pivotal condensation /... /right /so I'm now going to an example . illustrating how we use this method/"

A.10/18-20,24-25

3.3.Ex.54    "/right . /so . I will write down perhaps the most important equation of this sort ... /"

A.6/3-4

3.3.Ex.55    "/right . /so.the rule is therefore that the equation exists for every value of the free suffices /"

A.6/23-24

One feature of the resumptive 'so' that distinguishes it from the more specific 'so' is that in many but not all cases it takes a following silent stress and a succeeding step up in key.

#### OTHER CAUSAL RELATIONS

#### THEREFORE:

3.3.Ex.56    "/quite a large number of the grasses for example er depend upon the agency of wind (1) to carry . the pollen (2) /and its not surprising therefore . that in such plants (1) erm . the corolla . is usually rather small . and insignificant . for it's no need . as it were . to have a brightly coloured corolla (4)/"

A.38/10-14

3.3.Ex.57    "/now if its a good amplifier it will have both voltage gain and current gain /so V-out will be much larger than V-in and I-out will be much larger than I-in /therefore the power dissipated in the load is much larger than the power supplied to the input terminal/"

A.22/27-30

3.3.Ex.59    "/now as far as the load is concerned it doesn't know whether that's coming from a battery in here the voltage of which is changing with time or whether it's coming from a power supply unit via the amplifier in response to the



control signal/and as far as the load is concerned it doesn't care which of these two situations actually obtains /all it is interested in doing is getting its current at the right voltage /therefore . this sort of argument enables us to say that the amplifier with its transistor is an active network/"

A.28/11-21

We can see from these examples that 'therefore', like 'so' and many other conjunction items has a variable field of influence: it can relate back primarily to the preceding clause or it can signal a terminal stage in an argument.

THIS IS WHY:

3.3.Ex.60 "/and what it's done you see is to multiply by the gain of the amplifier the difference between the voltage on these two terminals /this is why we call it a differential amplifier /it measures the difference between the voltage on the two input terminals/"

A.21/35- A.22/1

### 3.3.4 TEMPORAL CONJUNCTION

Most of the temporal conjunctions employed in lecture discourse refer not to the temporal succession of events in the external world but rather to the time scale of the communication process itself: they are mostly INTERNAL in function. The most typical temporal conjunction is 'then', with 'first of all' being almost as common. In this kind of discourse they most usually occur in the context of some kind of prospective focussing statement about the ensuing direction of the monologue. Their most typical environment therefore includes such verbs as 'deal with', 'describe', 'go through' which are usually in the



3.3.Ex.67    "/and er what I'm going to do is er put up a  
sort of general diagram first of all . /and then  
we'll er describe the various parts of the  
flower /and then later on go . into er go into .  
er . details of er variations which we find in  
the different parts /"

A.35/23-27

3.3.Ex.68    "/now first of all if you work up towards the  
apex of this structure this structure is called  
the . receptacle (8) strictly the floral . the  
floral receptacle/"

A.36/9-11

### 3.4 STRUCTURAL PARALLELISM AND LEXICAL REPETITION

Quirk et al in A Grammar of Contemporary English (p.715) state  
that:

"If two or more sentences have identical or very similar  
structure, this connects the sentences, the connection  
being reinforced by lexical equivalences and implications  
of semantic relationship."

In the examples below there is often a high degree of structural  
parallelism reinforced by repetition of words or whole phrases. Sometimes  
only one lexical item has altered as in 3.3.Ex.69, 3.3.Ex.70, 3.3.Ex.72  
and only short stretches of text are involved. In these examples  
repetition of structure and lexical items seems to have a cumulative  
reinforcing effect. Sometimes however, as in 3.3.Ex.77-80, longer  
stretches of text are involved and the effect of the repetition is to  
point up some contrast. In these cases there is a clear use of antonyms  
(wide v. narrow; inwards v. outwards; outside v. inside).

3.3.Ex.69    "/we shall be talking a bit about valves  
/we shall be talking about transistors .../"

A.20/7-8

- 3.3.Ex.70    "/we have an input terminal /and we have an  
output terminal/"  
A.20/22-23
- 3.3.Ex.71    "/we connect it to a given load (1) /and we  
drive it from a laboratory oscillator /we  
measure I-in and V-in/and we measure V-out  
and I-out /the power supplied by the oscillator  
is V-in I-in /and the power dissipated in the  
load is of course the product of V-out I-out/"  
A.22/22-26
- 3.3.Ex.72    "/we can design /we can analyse/"  
A.29/9
- 3.3.Ex.73    "/can it withstand the voltage /can it dissi-  
pate the power/"  
A.30/8-9
- 3.3.Ex.74    "/is it safe /is it reliable/"  
A.30/20
- 3.3.Ex.75    "/if I have some quantity here and I add  
something which is zero to it . it isn't  
changed /and if I add three point seven  
times that times zero to it it is still not  
changed/"  
A.11/8-11
- 3.3.Ex.76    "/this is the equation one times y plus nought  
equals nought /that is y equals nought /and  
this is the equation one times x minus one  
equals nought/"  
A.13/30-32
- 3.3.Ex.77    "/er (1) in the same way if the steele is er  
narrow then the cortex in the root will be  
wide /in the stem if the steele is wide . then  
the cortex will be narrow/"  
A.33/7-9
- 3.3.Ex.78    "/so in other words . in the root . the  
protoxylem is on the outside (1) and the xylem  
subsequent xylem forms inwards (1) /in the stem  
the protoxylem is on the inside and the subse-  
quent xylem metaxylem and so forth is produced  
outwards/"  
A.34/8-11

- 3.3.Ex.79    "/now of course er plants as you may know .  
erm flowering plants are of er two main kinds  
/there are those which complete their life  
cycle in a . single year a single growing  
season ./and these are what we call annuals  
(3) /and there are those which are . which go  
on from year to year . producing flowers each  
year . and increasing in er size . plant . /and  
these are what we call perennials/"

A.35/13-19

- 3.3.Ex.80    "/they also vary . in the degree to which they  
are joined together /sometimes you find that  
the sepals are quite separate . /and you can  
take er . a pair of forceps and pluck them off  
one by one (2) /sometimes you find that they are  
joined together /and the degree of join also  
can vary/"

A.36/1924

- 3.3.Ex.81    "/now the stalk of each stamen . is referred to  
as the filament (8) /and the head . of each  
stamen . is referred to as the anther/"

A.38/31-32

#### 4. COHESION AND DISCOURSE

The foregoing enumeration of the cohesive devices typical of lecture monologue provides much information on the surface markers that link one syntactically independent unit with another. The description, however, remains - for all its detail - somewhat unmotivated and impoverished. It would seem that the mere description of linkages in a text cannot account for how that text holds together.

This is especially clear if we consider the particular area of conjunction. In describing conjunction, Halliday and Hasan make sense of the bewildering variety of explicit devices by clustering them together under four main headings: the additive, the adversative, the causal and the temporal. The rationale for such a scheme is presented as follows:

"the fourfold scheme we have adopted here is simply the one we have found most helpful in the quest for a general characterisation of cohesive relations which would not be 'closed' - which would allow further sub-classification as and when needed."

(p.321)

However the exact status of such relations remains unclear, as may be seen in the following quotation:

"These relations constitute a highly generalized component within the semantic system, with reflexes spread throughout the language, taking various forms and their cohesive potential derives from this source."

(p.227)

Nonetheless the underlying suggestion would seem to be that these relations exist between components of a text independently of an explicit signal by a conjunctive item. Indeed Halliday and Hasan recognise as much when they argue that:

"This explains how it is that we are often prepared to recognise the presence of a relation of this kind even when it is not expressed overtly at all. We are prepared to supply it for ourselves, and thus to assume that there is cohesion even though it has not been explicitly demonstrated."

(p.229)

This would seem to be a **crucially** important claim for it suggests that there is a finite and closed set of possible relations between one syntactically independent unit and another and that these relations obtain independently of the surface marker. If the relations are limited in number, then the possible ways of combining one syntactically independent unit with another become predictable, not random.

Predictability above syntax suggests in fact another level of structure.

Over and beyond the notion of a finite and predictable set of relations there is also the question of what exactly is linked together by cohesion. Halliday and Hasan view cohesion purely in terms of intersentence connection. But one fact that clearly emerges from the foregoing enumeration and exemplification of devices is their variability of domain. It is not just sentences or even syntactically independent units that are linked by cohesive devices, but varying sized components of a text. Indeed I would argue that far from being merely intersentence connectives, cohesive devices are also surface markers of units of supra syntactical organisation. Instead therefore of separating cohesion from discourse (or 'coherence'), I consider the areas to stand in a reciprocal relationship. Without a notion of discourse structure the study of cohesion appears unmotivated. And on the other hand certain cohesive devices provide an insight into discourse structure. Only if the two areas are integrated can the full potential of either mode of analysis be revealed.

A proposal to integrate the two areas of study has in fact been advanced by Gutwinski (1976). Above the level or stratum of grammar he posits a further level called the semologic stratum and discourse structure is stated in terms of the units of, and the relations obtaining on, this stratum. In the case of a narrative the semologic stratum (or discourse structure) can be represented in terms of an event-line consisting of "actions" and "connections". In addition to the event line of the narrative, the relationships of participants to "actions" can also be stated. This is done in terms of a small set of roles for which agent, goal, beneficiary, affected, causer etc. are considered appropriate labels. The structural organisation of

language is thus seen as moving from surface structures at the level of phonology, through the relatively less shallow level of grammar to the deeper underlying structure of the semologic stratum, which is seen as the deepest and most abstract level of organisation. As a consequence of being the most abstract level, "the structure of the semologic stratum is not directly observable since it is not represented directly in the grammar and even less so in the phonology of the language" (p.25). Nonetheless, it is felt that "this deeper, underlying structure finds its manifestation in the relatively shallower structure of the grammar and is still recoverable from it" (p.25). Accordingly Gutwinski proposes that : "A fruitful avenue for English discourse studies lies ... in the examination of these units and relations obtaining on the grammatical stratum which are felt to be realisations of the discourse structure on the semologic stratum" (p.25). These units and relations on the grammatical stratum which partly reflects the discourse structure are considered by Gutwinski to be basically such cohesive devices as reference, substitution, conjunction, and lexical cohesion. Although "cohesion as defined in this study does not constitute discourse structure", nevertheless "it reflects indirectly, perhaps in part only, the underlying semologic structure of a text, that is, the discourse structure conceived at the semologic stratum" (p.26).

The only problem here seems to lie with the nature of the units that form discourse structure on the semologic stratum. An event line consisting of actions and connections with various role relations for participants would seem only applicable to narrative - a very particularised form of speech genre. The categories themselves seem to have no constituency relationship among them and hence cannot be organised hierarchically. Furthermore, since they have no direct



realisation in any other level it seems difficult to know on what basis they have been elaborated. This latter point is related to perhaps the key question of in what sense discourse structure should be seen as "deep" and "underlying". Gutwinski, for instance, claims that the semologic stratum is hardly manifest at all at the phonological level. As we shall see in Chapter IV, however, suprasegmental phonology can be closely related to discourse structure.

A more satisfactory attempt to integrate cohesion with the study of discourse is set out in an as yet unpublished paper by M. Stubbs on the discourse structure of committee talk. In this paper he observes that the boundaries of 'sequences' (the discourse unit on the rank scale above 'exchange') "are marked partly 'negatively', by breaks in surface cohesion" (p.24) and that "boundaries ... tend to co-occur with breaks in discourse cohesion". (p.25) He lists certain cohesive devices such as lexical cohesion, ellipsis, parallelism of syntax, and logical connectors which provide "indications that the speaker is in the same sequence" (p.25-6) and argues that "it is often possible to isolate sequences mechanically from the data using only such surface cues as these" (p.26).

"The claim is, then, that the surface markers listed tend to cluster together across strings of utterances, but that fairly sharp breaks occur in the clustering and that these breaks are heard as shifts in 'topic'."  
(p.27)

Stubbs' position is in fact similar to that of Gutwinski. Where he seems to go beyond Gutwinski is in specifying more closely the nature and relationships of units and structures on the discourse level to which variations in cohesive structure pertain. Furthermore,

these units and structures have a more direct realisation relationship with the surface of text or discourse. We consequently have a clearer notion of how they have been derived or conversely how they are expounded in the data.

The trend of this discussion has been towards a claim that some aspects of cohesion are not simply a matter of intersentential connection but may in fact reflect patterns of discourse. It seems fairly clear from the summary of cohesive devices that particular items can signal or mark a relationship not just between syntactically independent units but larger scale components of text. The items themselves can be seen as ranging on a line from those linking small scale units, such as substitution, to those such as various forms of conjunction and extended text reference which are more commonly associated with linking larger components. As a way of representing that cohesive devices can have varying domains we propose a tentative distinction between 'micro' and 'macro' - cohesion. It is not of course a hard and fast distinction: a number of cohesive devices, such as 'but', 'so' and 'or' for example, appear capable of operating at various points on the line.

The devices themselves are seen as reflexes in the lexicogrammatical systems of the language of discourse patterning. They are thus seen as representing the formal features or surface markers of discourse structure. The next chapter draws implicitly on the analysis of cohesion set out in section three above to isolate different functional roles for the lowest unit of discourse. At this stage we work within the hypothesis that this discourse unit is in fact coterminous with what we take to be the largest unit of grammar - the clause cluster. Thus we see the clause cluster as operating at the interface between grammar and discourse.

From the perspective of discourse we term this unit the MEMBER.

(In so doing I draw on Winter, 1976, p.2.: "The basic unit of discourse structure is the member". He in turn derives the term from Quirk, 1954. It is used here, however, in a slightly different sense. Winter uses it to refer to a sentence or sentences standing in close relationship with another sentence or set of sentences, either side of the relationship constituting a MEMBER. Here it is used merely to refer to a syntactically independent unit fulfilling a discourse function.)

Earlier in the chapter it was suggested that larger scale units of discourse can be isolated by the focusing activity which occurs at their boundaries. This larger scale unit we call (following Straker - Cook, 1976) the EPISODE. MEMBERS, we assume somehow combine together to form EPISODES. In Chapter IV we suggest that at least one intervening unit can be isolated on phonological criteria as mediating between MEMBER on the one hand and EPISODE on the other. We call this mediating layer of structure the PERIOD. In phonological terms PERIODS are seen as having a specifiable prosodic shape: crudely speaking, the pitch of the lecturer's delivery is high at the onset of the PERIOD and low at its closure. Thus, PERIODS involve a progressive stepping down in pitch (or KEY) from one tone unit to the next.

In the light of this brief sketch of the putative discourse structure of lecture monologue we now turn to an analysis of discourse functions primarily at the layer of MEMBER.

### CHAPTER THREE

LECTURE DISCOURSE :

FUNCTION and PLANE

## 1. INTRODUCTION

The main concern of this chapter is with categories of FUNCTION - categories which are seen as pertaining to the lower layers of discourse structure and primarily to the domain of member. Members are seen as expounding one or other of a set of functions and the total range of functions is seen as susceptible to a binary division indicating two distinct but complementary strands of discourse amounting to separate discourse PLANES.

### 1.1 A NOTE ON FUNCTION

The functional classification of utterances is of course fraught with difficulties. Often a given set of functional categories are not mutually exclusive and consequently the same piece of language may be seen as a realisation of more than one kind of function. Frequently the addition or subtraction of a label from a given functional set does not alter the meaning of all the others. Further more, the means by which the categories are derived are rarely made explicit and it is difficult to relate the categories to the data in a principled and unambiguous fashion. It is also difficult at times to know why these particular categories have been set up and no others : why not more - or less, for that matter. Indeed functionally defined categories have an unfortunate ad hoc quality about them, and a consequent tendency to proliferate beyond the point of usefulness.<sup>1</sup>

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1. In noting these objections I have borne in mind Halliday's requirements for terms in a system of linguistic description as set forth in "Categories of the Theory of Grammar", Word, vol.17,1961.p.247.

John Sinclair's article 'Linguistics in Colleges of Education' (see Dudley Journal of Education, 1973,pp.17-25) has also been useful in this respect. The relevant pages are quoted in Sinclair and Coulthard (1975), pp.15-17.

I have tried to avoid these difficulties as much as possible by :

(a) restricting the notion of function to 'internal effect on the discourse organisation of the monologue';

(b) attempting as much as possible to give clear recognition criteria for exponents of a functional label in terms of surface features of the language;

(c) despite attention given to the surface realisation of categories, I have attempted to keep the scope of these labels relatively abstract in the hope of reducing their tendency to proliferate.

## 1.2 A NOTE ON PLANE

The notion of discourse PLANE was first formulated in Professor Sinclair's inaugural lecture (1966) "Indescribable English" where, in a discussion of the appropriacy of sequential utterances, the possibility was noted of changing the PLANE of discourse by referring to the grounds of the utterance itself. A reply such as 'What do you mean, enjoy?' to the question 'How are you enjoying Birmingham?' shifts the orientation of participants to the presuppositional grounds of the discourse itself, and these presuppositions have to be examined before the discourse can resume normally. The intervening interruption of the discourse can be termed a PLANE CHANGE.

This notion of PLANE CHANGE underlies the identification of FOCUSING moves observed in the classroom and described in Towards an Analysis of Discourse (Sinclair and Coulthard, 1975):

"Focusing moves represent a change of plane. The teacher stands for a moment outside the discourse and says 'We are going to/have been communicating; this is what our communication will be/was about'(p.45)

Lectures as extended monologue are in fact particularly rich in focusing activity which is hardly surprising since they usually consist of delivery by a single person of complex subject matter in the form of an hour's uninterrupted talk. In these circumstances, organising the flow of talk - both from the viewpoint of the speaker's delivery and the audience's comprehension - is a key and clearly acknowledged problem. For this reason and also because it is well documented in other kinds of discourse (e.g. committee talk, the classroom, etc.) focusing as plane change is not perhaps as interesting as another kind of plane change that seems on the surface peculiar to lectures.

In broad terms this further kind of plane change amounts to a constant effort by the lecturer to make his meaning clear by resort to various forms of repetition, reformulation, qualification etc. Allied to this activity is the related form of plane change which amounts to digressions, parenthetic asides, etc. This notion of changing the plane of discourse may be illustrated more clearly in the following example:

PLANE X

/(M1) I shall be concentrating  
mainly on amplifiers for  
amplifying sinusoidal  
signals - AC signals,  
alternating current/

/(M8) so we shall be dealing  
with small signal and large  
signal AC amplifiers and  
amplifiers of steady  
voltages - DC amplifiers

PLANE Y

/(M2) this is a misnomer/(M3) to  
say it's an alternating current  
voltage; an AC voltage, as so  
many people do of course is a  
bit of a nonsense/(M4) erm we  
all do it/(M5) so I'm afraid that  
I'm going to have to use this rather  
loose terminology/(M6) I hope you'll  
know what I mean/(M7) I mean a  
periodically time varying signal  
which is probably sinusoidal/

Members 2 - 7 in the example qualify the sense and reference of items introduced in Member 1. Member 8 in fact seems to resume the orientation of the discourse at Member 1 and while it takes account of the intervening members it nevertheless appears to be a continuation of the discourse at the first member, or a reinstatement of the original 'direction'. The intervening Members 2 - 7 are thus seen as operating on a separate plane with plane change at the onset of Member 2 and Member 8.

In some respects the phenomenon being dealt with here bears a recognisable similarity to features of interactive talk discussed in terms of "side sequence" or "insertion sequences" by Jefferson (1972) and Schegloff (1972) respectively. The latter kind of formulation, however, introduces the notion of "embedding" into the description of spoken discourse - a medium which is probably best treated, as much as possible, as a linear mode where any choice along the axis of chain is susceptible to the influence of previous choices. In the example above, for instance, it is not possible to claim that the resumption at Member 8 of the discourse orientation of Member 1 takes no account of the intervening members. There may be some dislocation in the flow of discourse (similar to, for example, Jefferson's 'misapprehension sequence') but when the orderly flow resumes it carries forward with it the activity undertaken at the dislocation. It is therefore not 'inserted' or 'embedded' in the sense that subsequent discourse can resume 'as if nothing had happened'.

Although the notion of separate planes of discourse does carry structural connotations it is being used here primarily as a more abstract way of talking about discourse function since separate discourse planes carry members whose functions are by and large specific



to that plane. They can be seen as analogous to Labov's "actions at higher levels of abstraction" (see Labov, 1972, p.123)

## 2. LECTURE DISCOURSE

Lecture monologues are seen as proceeding by an interplay of two different modes of discourse : there are members whose main orientation is towards the subject matter of the lecture; and there are members whose main orientation is towards the reception of this subject matter. One strand of the discourse is primarily oriented towards describing and explaining the phenomenon in question; interwoven with this strand is another whose concern is with monitoring, reflecting upon and commenting on the primary thrust of the discourse. These two strands are seen as constituting discourse activity on separate planes.

How to label these planes presents some problems. They could be called primary and secondary discourse, or main and subsidiary discourse, or derivable and non-derivable discourse, or even message and the setting of message. Each pair of labels is suggestive of some features of the data but all suffer the disadvantage of either over-emphasising a crude content/form dichotomy or concentrating exclusively on information as a core strand in the discourse. For while we may intuitively accept the transmission of information to be a fundamental purpose of lectures it would seem nonetheless that the "informing" strand is heavily dependent on the attendant and inevitable glossing activity. Indeed this supportive glossing often carries a burden of information which is by no means negligible.

While bearing in mind these reservations we will, however, term the two planes of discourse MAIN and SUBSIDIARY.

## 2.1 SUBSIDIARY DISCOURSE

The activity of SUBSIDIARY discourse may be further broken down into two main kinds: GLOSSING and ASIDES.

GLOSSING<sup>1</sup> activity is closely related to the primary thrust of the MAIN discourse: its role is to reflect back on, to modify, evaluate and comment on the MAIN discourse.

ASIDES bear a more tenuous relationship to the main discourse. They involve a more marked degree of PLANE CHANGE.

### 2.1.1 GLOSSING

The activity of glossing may be described in terms of three main functions: RESTATEMENT, QUALIFY, and COMMENT.

#### 2.1.1.(a) RESTATEMENT

Restatement appears in a variety of forms of which three in particular

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1. The term "glossing" has in fact been used by Garfinkel and Sacks (1969) for whom it seems to have many senses. In its most fundamental sense it seems related to their observation that it is impossible to say in so many words what a text means. In this context glossing is used to denote the reflexive activity undertaken by conversationalists to clarify the presuppositions, status and meaning of conversational accomplishments (e.g.: "are you asking or telling me?"; or, "you're just making excuses", etc.)

For Garfinkel and Sacks, glossing is also related to the problem of indexical expressions, the reference and truth value of which is always indeterminate depending as they do on participants' interpretation of what features of the context are relevant to their disambiguation.

Here the term is used more restrictively to embrace the particular set of functions described below, though the ethnomethodologists' more global observations are not without relevance.

have been distinguished.

RESTATEMENT : REPEAT : this category refers to those members which repeat whole or a substantial part of a preceding member.

Ex.1 /there's a so-called passive network represented by a box say with two terminals.  
/and it may have resistors in it. and the odd capacitor.  
but nothing else

REPEAT     /it has resistors inductors or capacitors in it  
A.26/32-35

Ex.2 /now transistors in themselves aren't sources

REPEAT /it is not a source of power.

A.27/28-9, 30-31

Ex.3 /and as far as the outside world is concerned, it is very convenient to represent the transistor, plus its power supply, as a source

REPEAT     /but its very convenient from the point of view  
             of analysing what goes on in these circuits to say  
             that its the transistor that's the source.

A.27/38-A.28/

RESTATEMENT : EXPOSITION : This category embraces all those members prefaced by such surface markers as "that is", "in other words". Occasionally they merely reformulate a previous member but they also quite typically introduce new information in the course of the glossing activity.

Ex.4 /is there a cheaper solution

EXPOSITION /in other words can you use a cheaper device.

A.30/16-17

Ex.5 /... let us in this case say it is. a sinusoidally  
ranging signal - a sine wave from a laboratory  
oscillator, connected to its input

EXPOSITION /in other words the input signals.the voltages are injected with respect to earth potential

A.20/26-29

Ex.6        /Right now let's look at er.a two dimensional array.aij  
EXPOSITION /that is it has two suffices

A.3/38-A.41

RESTATEMENT : REPHRASE : In many respects this category is very similar to the previous one, except that exponents of it do not include in their realisation the surface markers of exposition. They also in some ways seem more emphatic than exponents of the previous category, perhaps because in prosodic terms they tend to be slower in tempo than expositions.

Ex.7        /now,there are many amplifiers today.which don't just  
             have one input

REPHRASE    /they have two inputs.

A.21/10-13

Ex.8        /these are steady voltages not changing with time.

REPHRASE    /these are our so-called DC inputs. the steady input  
             voltage

A.22/11-18

Ex.9        /as such its a source of power (1)

REPHRASE    /it's a direct.current source.

A.23/2-3

Ex.10       /... all the power fed to that load.is derived from  
             that power supply (4)

REPHRASE    /virtually none of that output power.is supplied  
             by the input (3)

A.23/22-24

Ex.11       /your hand.isn't supplying any of the water.

REPHRASE    /it is merely supplying.the information to control the  
             amount that goes through

A.23/37-38 -A.24/1

Ex.12       /and er these er buds.in general.have the charactertistic  
             of.indefinite growth

REPHRASE    /once they begin to develop they go on and on

A.34/32-33

Ex.13        /the output signal.will not be quite the same as the  
              input signal.

REPHRASE     /it will be a distorted version of the input signal

A.25/20-22

2.1.1.(b) QUALIFY : whereas the first category (with its three sub-  
divisions) refers to those members which repeat or expand the meaning  
of a previous member, exponents of this category serve to modify the  
general applicability of a preceding member. In their realisation  
they display two salient features : they typically contain some surface  
marker of the qualification, such as "actually", "in reality", "at least",  
etc., and/or they display some reversal of polarity.

Ex.1        /the rank (3) of.an array (3) is the number . of  
              suffices

QUALIFY     /I should actually be more precise.free suffices

A.4/4-5

Ex.2        /and in designing an amplifier you strive to get this  
              linear relationship

QUALIFY     /it can never be.completely linear.

A.25/14-15

Ex.3        /therefore.this.sort of argument enables us to say.that  
              the (1) amplifier with its transistor is an active network.

QUALIFY     /in reality the transistor on its own is a purely passive  
              device

A.28/20-22

Ex.4        /all these equivalent circuits are experimentally  
              determined

QUALIFY     /at least they have a basis in experiment.

A.29/26-27

2.1.1.(c) COMMENT: exponents of this category evaluate or comment  
on stretches of the discourse. They often include a text reference  
item such as "this" or "that" and an attributive term such as "important",

"simple", "difficult", "trivial".

Ex.1 "and that all sounds rather complicated"

A.5/25

Ex.2 "it may seem very trivial just telling you how to  
write the things down"

A.3/8-9

Ex.3 "I think its fairly obvious"

A.4/6-7

Ex.4 "and these are the ones that we're interested in"

A.27/6-7

COMMENTS express some attitude towards the previous piece of discourse, evaluate it in some way or comment on its status. They are particularly important insofar as they are explicitly oriented towards reception of the discourse and indicate an internalisation of possible audience reaction within the discourse itself.

We may summarise the main realisations of glossing activity as follows.

GLOSSING	{	RESTATEMENT; REPEAT, EXPOSITION, REPHRASE.
		QUALIFY
		COMMENT

Exponents of these categories form the core of SUBSIDIARY discourse. They reflect back on the MAIN discourse, expanding it, modifying it and evaluating it. Members that expound these categories are in all cases (except perhaps that of COMMENT) closely related to the primary thrust of the discourse and have a close dependency relationship on main discourse members. They are said very much in the context of what has gone before. But they are not predicted by the previous discourse nor are they predictive in themselves. Instead

their organisation and interpretation seems to be a continuously retrospective one. It is noticeable in this respect that they tend to display many features of micro cohesion: 'it' and 'they' used as specific rather than general reference items - and hence micro-cohesively - are associated with RESTATEMENTS (REPHRASE); the additive conjunctive relation of expository apposition which typically operates only between members is associated with RESTATEMENTS (EXPOSITION).

### 2.1.2 ASIDES

The second basic constituent of SUBSIDIARY discourse differs from GLOSSING activity insofar as it maintains a more tenuous relationship with the main flow of the discourse. It involves a more marked degree of PLANE CHANGE. ASIDES also vary considerably in extent. At one extreme they may consist of a whole string of utterances that stand outside the main drift of the discourse. At the other extreme they may amount to an insertion within an utterance.

ASIDES are marked by the direction of the subsequent discourse which usually makes reference back to the discourse immediately preceding the PLANE CHANGE.

The function of an ASIDE is often to contextualise the discourse in some way: for example, it may link abstract description to concrete blackboard illustration or it may relate the process of description to some further activity to be undertaken by the audience or to some previous information supplied to them.

The variable extent of ASIDES may be seen in the following example in which the first ASIDE is embedded in a member but the second ASIDE becomes a lengthy digression. This second ASIDE is marked at its onset by the item 'incidentally' and the return to MAIN discourse is marked by the utterance "but the rule about being on the same radius still holds good". This utterance reiterates items from those members which precede the aside: "... the xylem and phloem are on the same radius", "these are on the same radius".

Ex.1 /in the stem.er the situation is different.because the  
xylem and phloem are on the same radius (1)

/now if you have a stem with separate vascular bundles  
like this. and so on (1)

ASIDE 1 just show xylem and phloem for simplicity -  
xylem here phloem towards the outside

these are on the same radius

ASIDE 2 /er not all incidentally not all stems have this  
arrangement of separate vascular bundles,  
/these are always taken this type of stem is always  
taken as the type for the herbaceous dicotyledonous  
stem the young herbaceous dicotyledonous stem  
/but er it only really represents about half (1) er  
of the flowering the dicotyledonous flowering plant  
kingdom because about an equal number of plants have  
(1) a continuous ring of phloem and a continuous  
ring of xylem on the inside (1)  
/and er why this is never brought out.er.in er elemen-  
tary courses er I don't know because this is not  
necessarily representative of structure as a whole

/but the rule about being on the same radius still holds good  
/if we have a complete ring of phloem and a complete ring of  
xylem then ...

A.33/21-37

Specific lexical and grammatical features are of course not always of themselves an infallible indicator of ASIDES. They are also signalled however by intonational features such as selection of lower key, acceleration of tempo and a comparative drop in the frequency of tonic syllables.



Particular realisations of ASIDES may be distinguished as follows:

2.1.2.(a) PROCEDURAL. Almost invariably lectures in science and engineering subjects are accompanied by some form of visual display. This can take various forms - from the static diagram to the more dynamic process of blackboard calculations. Whatever the form however the illustrative material is referred to in the discourse and more importantly both shapes and is shaped by it. It plays an important role in the discourse almost to the point of operating as a kind of sub-text. We have adopted the term PARADISCOURSE to highlight its characteristic of running parallel to the monologue with a supportive function to the discourse.

One of the ways in which PARADISCOURSE is related to the discourse is by the use of PROCEDURAL asides. ASIDE 1, cited above, is a PROCEDURAL.

PROCEDURALS can also serve to establish the terms within which subsequent communication will take place.

Some further examples are given below:

Ex.1 /in the stem the protoxylem

PROCED. /this is the inside of the stem/  
the protoxylem will be found here/

A.34/6-8

Ex.2 /so aij is.similarly.shorthand for set of numbers

PROCED. /we wrote it down last time  
/I won't write them all down/

a one two a one one a one two up to a one n/

A.4/10-13

Ex.3 /We will look for three properties commutation.add.  
multiply.

PROCED. /we'll make a little table./

/commutation is the statement under addition that a  
plus b equals be plus a/

Ex.4 /an active network is one that contains a source/this  
may be a source of voltage.or a source of current (4)  
a battery a source of voltage.or.an AC voltage source -

PROCED. /this is a symbol of a DC voltage source -  
a direct voltage source - a battery/ this  
of an alternating voltage source/

/or it may contain current sources which has a symbol  
like that./

A.27/7-12

2.1.2.(b) RECALL. Exponents of this kind of ASIDE serve to reinstate  
at any juncture in the discourse some information which is treated as  
already familiar to the audience. Accordingly they typically contain  
some phrase such as "you will remember" or "as I said earlier".

Some examples are as follows:

Ex.1 /but as soon as you put it into a circuit. and you.do  
what you have to . to get the thing working .

RECALL. it's this process I referred to as  
biassing earlier on

then currents will flow through it.voltages will appear  
across it./

A.27/33-36

Ex.2 /in the root.the xylem and the phloem occur on different  
radii

RECALL. /remember this sort of business (3) the  
xylem here and the phloem in the grooves

/so that er thinking of the organ as whole ... er .  
the xylem main limbs as it appears in transverse section  
of the xylem are on a different radius from the phloem

A.33/15-21

RECALLS can appear as elements of the main discourse (cf. below)

An ASIDE may develop into a lengthy digression in which case it assumes structural characteristics similar in kind to episodes of the MAIN discourse. These characteristics will be further developed in the discussion of MAIN discourse. We illustrate this and other characteristics of ASIDES in the example below:

<u>MAIN</u>	<u>SUBSIDIARY</u>
Ex.3.INFORM an active network is one that contains a source	
INFORM This may be a source of voltage or a source of current a battery a source of voltage or an AC volt- age source	
INFORM or it may contain current sources which has a sym- bol like that	<p><u>/GLOSS/</u></p> <p>RESTATE this is a source of current</p> <p>(COMMENT its a bit unfortunate we ( don't have a different sym- ( bol to distinguish between ( direct current source and ( alternating current source A (RESTATE we use the same symbol ( S (PROCEDURAL but the fact that it's a ( capital I tells you you I ( have alternating current ( here D (PROCEDURAL /you still have a difference ( in symbol although they tend E ( to be used this can be used ( to represent a DC voltage ( source as well /there's no (COMMENT special agreement on this. ( (PROCEDURAL /a capital V will tell you ( its a direct voltage (PROCEDURAL /a little v will tell you ( its an alternating voltage ( (CONCLUDE so capitals denote steady ( values, little letters lower ( case letters denote er al- ( ternating quantities (</p>

FOCUS now any network which

which contains one or other  
of these or anything or com-  
binations of these or anything  
else - resistors, inductors,  
capacitors - is essentially an  
active network.

FOCUS            now there's one additional  
                 type of network that can be  
                 said to be an active network

A.27/7-26

One further feature of ASIDES that we may note is a tendency towards a more extensive use of 1st and 2nd person pronouns ("I", "we", and "you"). The tendency is for these pronouns where they occur in ASIDE to have a more restricted range of reference than in MAIN discourse. In MAIN discourse (with the exception of FOCUSING moves) "we" and "you" are most often used impersonally, to denote the 'impartial observer', 'the scientist' or the practitioner of the subject matter of the discourse (See Chapter II above). When they occur in SUBSIDIARY discourse they more typically refer to those immediately present at the speech event.

In general we may say that a PLANE change from MAIN to SUBSIDIARY discourse is often accompanied by a switch in grammatical subject from a nominal group (e.g. "an active network") or third person impersonal pronouns ("it", "one") to more personal forms ("we", "I", "you"). The presence of the lecturer and his audience is usually more prominent in ASIDES than in the immediately preceding or subsequent discourse. All the following examples for instance are taken from ASIDES.

/we wrote it down last time / I won't write them all down/

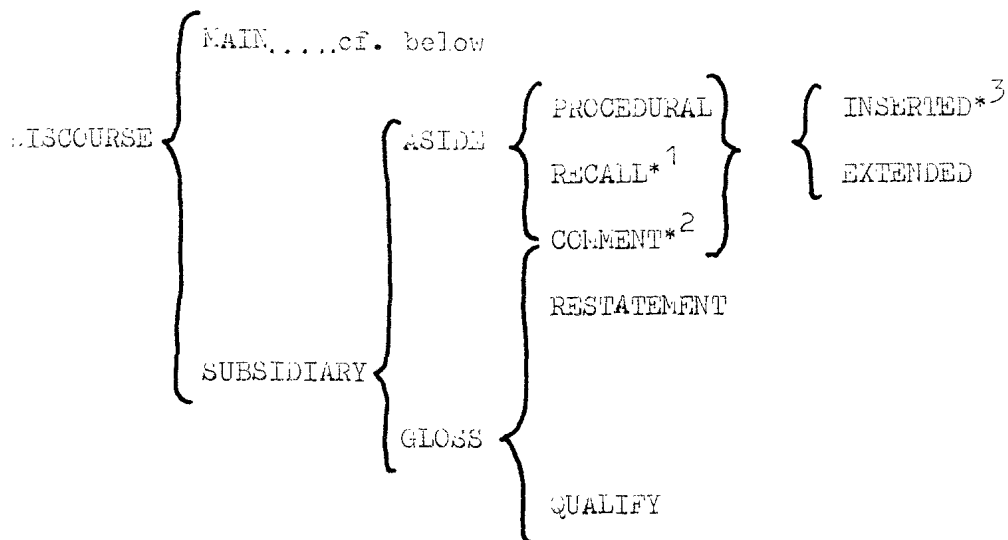
/we'll make a little table/

/two suffixes are the same remember we have special rules operating/

/we use the same symbol/

/you still have a difference in symbol/

We may summarise this section on SUBSIDIARY discourse as follows:



Notes: \*1 RECALL as noted earlier can form part of MAIN as well as SUBSIDIARY discourse

\*2 COMMENT is unusual in as much as it may constitute an ASIDE or a GLOSS (cf. 2.1.1.(C) Ex.3)

\*3 ASIDES may be either inserted within an utterance or it may be more extended and independent of the surrounding text.

## 2.2 MAIN DISCOURSE

As a crude oversimplification we can say that MAIN discourse alternates between two types of member - FOCUSING members and INFORMING members: the lecturer says what he's going to talk about, says it, and then sums up what he's said. This kind of sequence is said to be a DISCOURSE EPISODE. FOCUSING members account for activity at BOUNDARIES of EPISODES; INFORMING members constitute the body of EPISODES. Two kinds of FOCUS are distinguished; those which open EPISODES and those which close them. The former is considered to be a PROSPECTIVE FOCUS and the latter a RETROSPECTIVE. An ideal typical example of a main discourse episode is thus seen as taking crudely the following form (we ignore for the moment the intervening discourse layer of PERIOD).

MAIN DISCOURSE : EPISODE = (FOCUS : PROSPECTIVE), INFORM(S),  
(FOCUS : RETROSPECTIVE).

### 2.2.1 FOCUSING : PROSPECTIVE

Exponents of the prospective focus serve to orientate the hearer to the topic of the subsequent discourse and can be clustered into three basic sub-types; METASTATEMENTS, HEADINGS and RHETORICAL QUESTIONS.

PROSPECTIVE FOCUS : METASTATEMENT.

Lectures in general are curiously rich in metastatements and display wide variety in their form. Some examples are given below.

Ex.1 I'm going to talk about electronic circuits

A.17/36

Ex.2 I shall be concentrating on amplifiers for amplifying sinusoidal signals - AC signals - alternating current

A.19/15-16

Ex.3 well let's ask ourselves what is it an amplifier's intended to do

A.20/18-19

Ex.4 right/so let's turn to mathematics for the next forty five minutes

A.3/1

Ex.5 now I can put in some extra little definitions which er are necessary in order to er work freely with matrices

A.4/35-37

Ex.6 right. I'm now going to go right away from this rather abstract approach and talk about the solution of sets of linear equations ...

A.9/28-30

Some formal features of FOCUSING metastatements are as follows:

(1) 1st Person plural imperative

("let us", "let's")

(2) Verb forms expressing 'future of present intention'

"going to")

(3) Lexical verbs such as:

"talk about"

"ask"

"consider"

"explain"

"concentrate on "

(4) Lexical items referring to the discourse

"definitions"

"example"

"point"

(5) Lexical items indicating stage in discourse

"final"

"the end"

Not all of these features of course need occur simultaneously. Perhaps the most prevailing feature however is selection of the future tense with first person as subject.

PROSPECTIVE FOCUS : HEADING. The second type of FOCUS likely to introduce an EPISODE is a generalised statement of the subsequent discourse topic.

Ex.1 now another important point that arises is the position  
of the protoxylem

A.34/3-5

Ex.2 now as soon as you've said that you can see that there  
are a number of ways in which an amplifier can go wrong  
or not give exactly what you want of it

A.24/5-7

Ex.3 erm another thing that we want is to say that the amplifier  
has a low intermodulation performance.

A.25/25-27

Ex.4 now there's one additional type of network that can be said to be an active network and that is a circuit containing a transistor a valve an FET or multiples of each of these or combinations of each of these.

A.27/25-28

The distinguishing features of HEADINGS are as follows:

(1) often includes a generalised noun phrase such as

"a number of different functions"

"another group of organs"

"a number of ways"

"one additional type of network"

These phrases usually predict some lexical realisation in the ensuing discourse which is required to complete the sense of the heading: the ensuing discourse usually provides some lexical differentiation of the heading's generalised noun phrase;

(2) in some instances the heading itself contains the lexical differentiation. The lexically differentiating items in these cases usually take separate tonic syllables. This is the case in Ex.3 above with "low intermodulation performance";

(3) often contains such modifiers as "another", "additional", "further";

(4) can also contain some metareference item such as "point", "issue", "problem" etc.

As with the defining characteristics of FOCUSING metastatements not all of these features may be present simultaneously.

PROSPECTIVE FOCUS : RHETORICAL QUESTION. The third subtype of PROSPECTIVE FOCUS is provided by RHETORICAL QUESTIONS.

Ex.1 "now what do I mean linear"

A.24/38



Ex.2 "er now how do we actually set about analysing an electronic network and electronic circuit and how do we go about the design"

A.26/30-31

Occasionally the first and third type of FOCUS may be conflated as in the following

Ex.3 "well lets ask ourselves what is it an amplifiers intended to do"

A.20/18-19

### 2.2.2 A NOTE ON "MARKERS"

A common feature of all three sub-types of PROSPECTIVE FOCUS is the manner in which they are typically prefaced by items such as "well", "now", "right". (One lecture begins with a veritable plethora of such items; "right, well now you'll remember at the end of the last lecture ..."). In the analysis of classroom discourse (see Sinclair and Coulthard, 1975) these were identified as MARKERS the function of which is "to mark boundaries in the discourse" (p.40). In the classroom, when they occur as a separate tone unit with falling tone and a following silent stress, they are considered to be realising FRAMING moves, which - in optional conjunction with FOCUSES - form BOUNDARY EXCHANGES. BOUNDARY EXCHANGES divide classroom discourse into TRANSACTIONS, the equivalent of which in lectures is the EPISODE. In lectures, however, there seems to be no one consistent and recurring identifiable phonological realisation of such items. Furthermore, within the discourse model so far postulated, it would be difficult to include them as discrete exponents of the rank of MEMBER, since all other units on this rank are isolated in terms of grammatical self-sufficiency. Nonetheless, they are extremely frequent in their occurrence in all the lectures that form the data for this study

and appear to have an important role in punctuating the discourse. As has been noted they frequently preface FOCUSING members of the prospective type. They also are common at the onset of PERIODS within EPISODES. In these respects they may be usefully contrasted with the common conjunctive items "and", "or", "but", "so", etc. These latter items typically link together series of INFORMING members and in so doing set up chains of logical relations which seem to correspond with the unit PERIOD. "Markers", on the other hand serve to break or punctuate these logical chains : in effect they 'wipe the slate clean'<sup>1</sup> of the logical chain formed by conjunctions and thereby signal that a new chain is about to commence; hence their common position at the onset of PERIODS and of FOCUSES. In effect they can be seen as the obverse of conjunctive items. And just as conjunctive items are dealt with as part of the realisation of units on particular ranks (see especially INFORMING members, below) or as part of the dual phenomenon of micro and macro cohesion, similarly "markers" have been included as aspects of the surface realisation of other categories. They could, for example, be viewed as a kind of zero or negative macro cohesion - instances of breaks in cohesive texture.

It must be admitted of course that the nature of this treatment is to some extent demanded by the exigencies of the particular discourse model - a model that attempts to reflect the patterning of a particular speech event. It is unlikely that other speech events or genres - especially those involving more than one interlocutor - could be handled by a model that conflates such lower ranks of discourse structure as "act" and "move". In such cases some conjunctive items (especially

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1. The metaphor is drawn from a paper by J.McH. Sinclair (1975), p.6

items such as "incidentally", "likewise", the resumptive "but", the resumptive "or" and the concluding "so") may well be best handled as a special case of discourse markers.

### 2.2.3 RETROSPECTIVE FOCUS : CONCLUSION

In addition to the class of members which orientate the listener to the subsequent direction of the discourse episode, there is a further class of members which bring episodes to a close by retrospectively summarising the previous discourse. They often repeat key lexical items (see below Ch.IV) from the body of the episode and their summarising role is most clearly apparent in instances where - by repeating lexical items and often whole phrases - they echo the form of the **HEADING** which announced the **EPISODE**.

Typically they contain some anaphoric text reference item such as "this", "that", "this process", etc. They also are most frequently prefaced by such items as "so", "therefore", "this is why", "and so", etc. Some of these items, of course, can also operate within **EPISODES** in linking **INFORMS** together. Their role in **CONCLUSIONS** may be distinguished in two related ways. First, in Halliday and Hasan's terms (1976, pp.240-4) they operate here **INTERNALLY** rather than **EXTERNALLY** : that is they denote a relationship that is established on the basis of the preceding discourse rather than a strictly causal relationship that may be perceived a priori in the external world of described phenomena. Secondly, they operate macro-cohesively at **CONCLUSIONS** as opposed to micro-cohesively between adjacent members within **EPISODES**.

Some examples of **CONCLUSIONS** are given below.



end with some kind of appositional element, ("analogue amplifiers" in Ex.1, "sine wave signals in Ex.2., etc.). In so doing they typically end with selection of LOW KEY - one of whose communicative values is 'equativeness' (see Brazil, 1975, p.21 : "By selecting equative low key the speaker exploits the possibility of alternative formulations of what, from the point of view of both participants, can be regarded as the 'same' matter". See also below, Ch.IV). In the examples above it is almost as if an alternative formulation or an appositional element has been produced in order to make LOW KEY selection necessary and inevitable. If the PERIOD is thereby closed by immediate subsequent selection of HIGH KEY then we can say that not only is the appositional element member final but it is also PERIOD final and ultimately EPISODE final. If the PERIOD continues beyond the CONCLUSION by subsequent selection of further MID KEY and LOW KEY choices then the episode is heard as continuing until the last tone unit selecting LOW KEY proclaiming tone before an immediately succeeding step up into HIGH KEY - in other words, to the end of the PERIOD. This is the case in example 5 cited above. We can sum up these observations as follows : EPISODES are terminated by RETROSPECTIVE FOCUSES typically delivered with a final LOW KEY tone unit : in cases where the PERIOD continues beyond the FOCUS the EPISODE terminates with the termination of the PERIOD.

#### 2.2.4 INFORMING

Between the beginnings and ends of EPISODES the MAIN discourse develops through a chain or succession of INFORMING members. These members are frequently linked together by a limited range of conjunctive items such as "and", "so", "but", "or", "so that". The chains of logical relations thus established are intermittently interrupted

by markers to form PERIODS.

Not every member of course is introduced by a surface signal of its plus or minus relationship (that is, a conjunctive item or marker respectively) with the previous member. Sometimes there is no formal item to indicate the relationship of the member to the preceding discourse. In the case of conjunctive items, however, there is good reason to believe that they signal a limited set of underlying inter-member relations by which the members themselves are interpreted even when the conjunctive item is absent. A suggestive a priori justification for this view is put forward by Eugene Winter (1976) in a paper entitled "A clause-relational approach to English texts":

"One theoretical argument in favour of having a limited number of ways of interpreting some sentence in the light of another is ... the lexical creativity of the clause functions of subject, verb, object, complement, adjunct, etc. in which there is no limit to the kind of detail selected as noun, verb, adjective and adverb etc. This is potential chaos which can be chaotic to our understanding in direct proportion to the complexity of detail in adjoining clauses. (Consider, for instance, the difficulty of trying to follow an unbroken succession of sentences of 100 words long.) We cannot tolerate a comparable creativity in our interpretation of the relation between sentences. This would add another kind of potential chaos to our inherent difficulties in communication. To avoid this second kind of chaos, clauses have to connect with other clauses in strictly predictable ways just as the lexical choices within the clause have to connect with other lexical choices in syntactically predictable ways. (p.48)

Winter proposes two fundamental ways of interpreting adjacent utterances - as either Matching or Logical sequence. Each type has subtypes however and for the purpose of this research a threefold division

has been found adequate.

Following Halliday and Hasan (1976), the three prime relations in lectures have been termed ADDITIVE, ADVERSATIVE, and CAUSAL corresponding to the three most frequent logical connectors or conjunctive items - "and", "but", "so" (see above Ch.II). An example of an EPISODE built up primarily from successive ADDITIVE relations is given below :

Ex.1    now    er I mentioned that in most cases the corolla is  
         large and coloured - sometimes assisted or replaced by  
         the sepals

ADDITIVE /and this is in connection er with the reprod-  
INFORM    uctive process because a great number of flowers  
         er depend er upon insects - flying insects er for  
         the process which we call pollination which we'll  
         come onto to later on

(GLOSS)    (what pollen is and how it works and so forth  
         we'll deal with in a subsequent lecture)

ADVERSA- /but    er conveyance of pollen from one flower  
TIVE       to another is an essential part of the reprod-  
INFORM    uctive process

ADDITIVE /and er the bright colour of the er penanth  
INFORM    particularly of the corolla is looked upon as  
         one of the features serving to attract er  
         suitable insects to the flower.

A.37/25-38

Frequently SECTIONS of MAIN DISCOURSE are interspersed with units of SUBSIDIARY DISCOURSE. The above example for instance is 'interrupted' by the GLOSS, "what pollen is ... subsequent lecture". One problem that arises out of this kind of discourse plane change is in dealing with the way in which resumption of the MAIN DISCOURSE is signalled. INFORMING members that immediately follow a unit of SUBSIDIARY DISCOURSE are frequently marked as plane changing by the use of "but" (cf. Ch.II pp 77-78). In these cases we have instances of where a conjunctive item assumes a discourse value derived from but transcending, its role

as logical connector. Accordingly it becomes a moot point whether it should be dealt with in analysis as a RESUMPTIVE member (thus displaying its plane change characteristics) or as an ADVERSATIVE INFORM (thus displaying its logical role as part of the MAIN DISCOURSE).

Once again, however, it is intonation that provides a method for detecting the plane change involved in switching from MAIN to SUBSIDIARY discourse. New members are normally signalled by initial selection of HIGH KEY. In SUBSIDIARY discourse, however, there is a tendency to resist selection of HIGH KEY for member initial tone units. (This point is considered in more detail in Ch.IV.

#### 2.2.5 RECALL MEMBERS

The role of RECALL moves has already been noted in the context of SUBSIDIARY DISCOURSE. They also however possess a potential for operating within the MAIN discourse. Here they usually occur near the onset of the EPISODE and operate towards a similar end as FOCUS : they set an informational context within which the subsequent discourse EPISODE operates. It is also noticeable that their frequency is greatest towards the beginning of a lecture. This tendency of occurrence is related to the factor which most distinguishes them from SUBSIDIARY RECALLS. The latter usually refer back to, or "recall", some element from the ongoing speech event. MAIN DISCOURSE RECALLS however often refer back to elements of discourse from a preceding speech event. They can also be used strategically to instate in the discourse some piece of knowledge as if it has already been treated somewhere in the course so far.



Ex.1 "Last time I talked to you er about. this suffix notation, which allows us to handle arrays of numbers, Aij things like, things like this Sijk . arrays of numbers and write down equations which apply to . elements of in arrays of numbers in a very compact and economical form/"

A.3/2-6

Ex.2 "remember if we take er an array which we will call xi ... this is shorthand for the set of numbers x one, x two, x three, up to xn - ordered set."

A.3/14-17

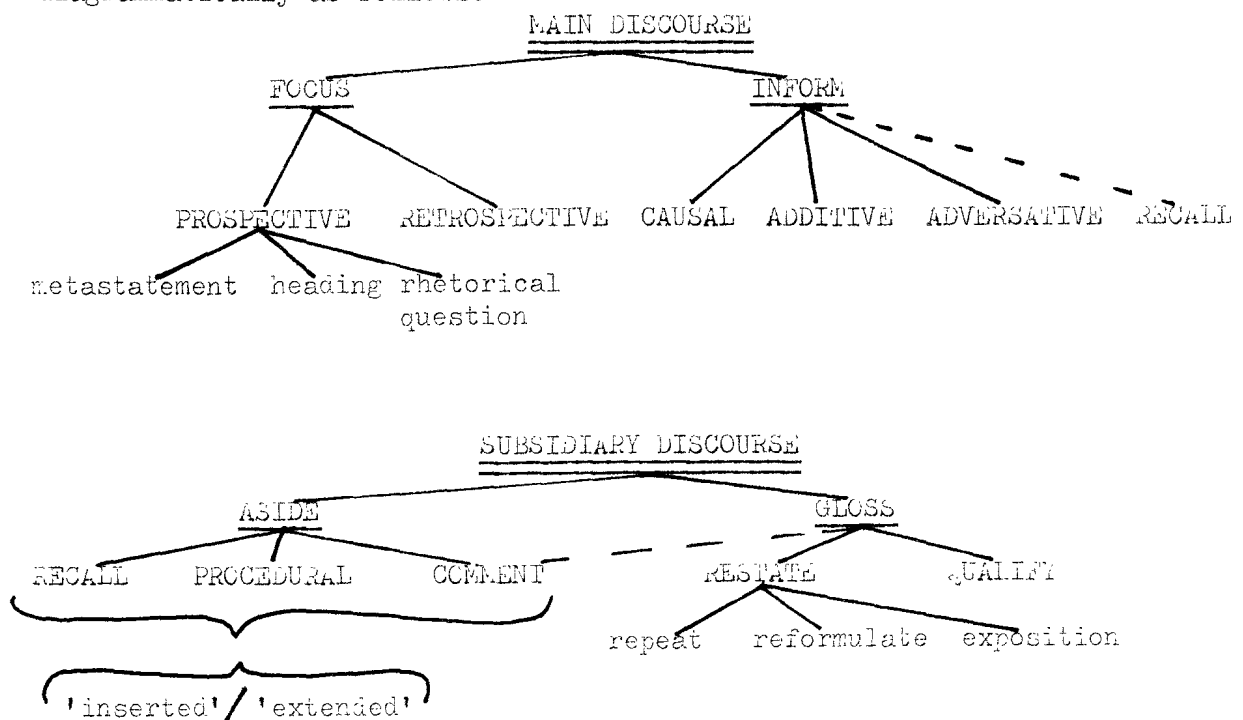
Ex.3 "remember this thing with er we had a simple diagram . showing soild level . the root system down here, and so for the main stems producing leaves, and having buds on it of two kinds . those which occur . in the angles formed between the leaf stalk and the stem which we call axillary er buds . and . the terminal bud (1)."

A.34/22-26

Ex.4 "now er I mentioned that in most cases the corolla is large and coloured sometimes assisted or replaced by the sepals."

A.37/25-27

In the light of the foregoing sections we can summarise the hierarchical relationship between functions in lecture discourse diagrammatically as follows.



### 3. A NOTE ON STRUCTURE

The model of discourse structure serving as a background to the observations of this chapter has been briefly sketched in terms of a rank scale of units. The smallest unit of discourse - the member - has been closely identified with the grammatical unit 'clause'. Members are seen as being syntactically independent units consisting of a free clause or combinations of free and bound clauses. More than one free clause can constitute a member but only when there exists between them an extremely close relationship of the branched type in which some necessary element of structure is ellided from the branched clause (see Sinclair, 1972, A Course in Spoken English : Grammar, p.32).

Members, singly or in combination form PERIODS which are defined phonologically by the pitch sequence of their tone units. Roughly speaking, periods begin in HIGH KEY and end in LOW KEY. The onset of periods can be additionally signalled by either negative markers of connectedness with the previous discourse (e.g. "now", "right") or higher order conjunctive items such as "incidentally", "likewise", etc. The structure of periods is capable of spanning across switch of plane from main to subsidiary discourse, although occasionally plane change coincides with the onset of a new period.

The continuous progression of periods in a text is intermittently punctuated by focusing activity of either the prospective or the retrospective type - occasionally by both in immediate succession. These constitute the boundaries of EPISODES.

This model owes much, of course, to other models of discourse previously elaborated to deal with such diverse speech events as the

classroom lesson, (Sinclair and Coulthard, 1975), the broadcast interview (Pearce, 1973), doctor-patient interviews (Coulthard and Ashby, 1973) and committee talk (Stubbs, 1973). These studies have all dealt with multi-party talk and have thus tended to operate with a four rank scale of ACT, MOVE, EXCHANGE and SEQUENCE or TRANSACTION. The main departure of this study has been to conflate the ranks of ACT and MOVE into the single rank of MEMBER. This, of course, is probably a distinctive feature of the particular speech genre - lecture monologue, as also is the way in which in this study discourse builds directly onto the level of grammar. Otherwise there is some degree of correspondence between prior notions of EXCHANGE and SEQUENCE/TRANSACTION and the notions of PERIOD and EPISODE expounded in this study. This reflects the interactive character of discourse even when it takes the form of a monologue conducted by one person. The discourse of lectures is, to use Volosinov's (1973) formulation of the discourse characteristics of written texts: "something like a vitiated dialogue worked into the body

of a monologic utterance. Behind the device of partitioning speech in units, which are termed paragraphs in their written form, lie orientation toward listener or reader and calculation of the latter's possible reactions. The weaker this orientation and calculation are, the less organised, as regards paragraphs, our speech will be. The classic types of paragraphs are : question and answer (where question is posed and answer given by the same author); supplementation; anticipation of possible objections; exposition of seeming discrepancies or illogicalities in one's own argument, and so forth". (p.111).

Many of his characteristics of "the classic type of paragraph" such as "supplementation" and "anticipation of possible objections" are similar to such functions of subsidiary discourse defined above as RESTATEMENT, QUALIFY, and COMMENT. Their presence in the discourse

of lectures, especially as the latter part of PERIODS, can be seen as an embedding in the monologic utterance of the exchange-type characteristics of multi-party talk.

At this point some further remarks can be made concerning the status of the structural unit EPISODE.

In this discourse model the structure of the lower ranks is fairly well defined. MEMBER, while having an internal syntactic structure, has no structure in discourse terms because it is the smallest unit on this level. (In this respect it is comparable with the unit morpheme in the level of grammar). Period is made up of one or more members and its structural boundaries are phonologically defined, thus giving it a clearly specifiable prosodic shape. In the case of each of these lower units of structure we can say that once either unit is begun its ensuing shape is predictable in syntactic or prosodic terms. EPISODE, however, seems to have no specified and predictable internal structure in terms of particular periods in sequence. It must, of course, contain at least one period and this in turn must contain at least one informing member but beyond these strictures there seems to be no way of specifying what further kinds of members and what kind of ordering for them obtains in EPISODES of extended length. Even a prospective FOCUS cannot predict the structure of an ensuing EPISODE. A lecturer, for instance, may announce that "in conclusion I wish to consider three further types of flowering plant". He may then, in fact only discuss two because he runs out of time, or remember an additional one and thus deal with four.

It would seem, therefore, that the structure of EPISODES is not predictive but emerges retrospectively as the unit unfolds. In this respect our findings concerning episode match those of other researchers.

Stubbs (1973), for instance, in dealing with sequences of exchanges in committee talk, declares : "We can, in fact, see no way at present of characterising any prospective sequence-structure. Our feeling is, rather, that sequences are characteristically retrospectively cohesive and coherent" (p.30). And Sinclair (1975), in a paper on discourse structure, writes:

"Immediately above exchange, the only patterns of language that we can detect are stylistic, and therefore fundamentally retrospective, because they are intermittent and their onset and termination are unpredictable" (p.12)

But, if EPISODE structure only emerges retrospectively and takes the form of intermittent patterning, then it becomes especially crucial to establish an intermediate layer of structure between EPISODE and MEMBER where patterning is more regular and predictable. We have in fact posited such a layer and claimed that it has a specifiable prosodic shape. The next chapter seeks to substantiate such a claim in the context of an overall examination of prosodic patterning in lecture monologue.

CHAPTER FOUR  
DISCOURSE and INTONATION.

## 1. INTRODUCTION

MEMBERS, it has been argued, can be functionally differentiated on the basis of their role in the discourse. It is thus implied that they play a role in the organisation of higher discourse units. Above MEMBER we have posited a unit of structure on a higher rank called PERIOD. PERIODS typically contain at least one main discourse MEMBER which can either be a FOCUS or an INFORM. They are also typically introduced by some kind of macro-cohesive device such as 'another thing' or 'so' and 'but' used "resumptively". They can also be introduced by some negative marker of cohesion such as 'now' or 'right'. In addition it has been asserted that PERIODS have a specifiable prosodic shape in terms of a pitch sequence from HIGH to LOW KEY. The ensuing chapter seeks to substantiate this claim and in so doing argues that intonation is a complex resource used by the speaker to signal the direction, organisation and informationally significant aspects of the discourse. In conclusion we make some observations on how PERIODS are realised in terms of constituent MEMBERS.

## 2. INTONATION AND DISCOURSE

Crystal (1969) remarks that

"Rarely does one find any recognition let alone discussion of the elementary fact that tone-units do not exist in isolation, but work in sequences in connected speech".

Instead intonation studies tend to concentrate on the attitudinal implications of certain contours (see, for example, Urdall, 1964) or the relationship of intonation to grammar (see, for example, Halliday, 1967) or intonation as a phonological system per se (see, for example,

Crystal, 1969). It is only recently that any attempt has been made to relate intonation choices to the process of interaction and to the organisation of connected speech. Brazil (1975) is the major exponent of this approach and his work has provided a number of useful insights into the organisation of lecture monologue. The remainder of this chapter relies heavily on Brazil's system although one or two important areas of difference will emerge in the subsequent discussion.

In Discourse Intonation (1975), Brazil delimits two important areas of suprasegmental phonological contrast. One is the well documented system of TONE or pitch-glide which applies at the tonic syllable of the tone-unit and contains five major terms corresponding to the five main nuclear types of pitch movement noted by other authors (e.g. Halliday, 1967 and Crystal, 1969).

However, in addition to the pitch change (or glide) which characterises the tonic syllable of the tone-unit, a further system called KEY is proposed which contains terms relating to the pitch level of the tone-unit's tonic segment. Thus it is argued that the relative height at which pitch movement takes place is as significant as whether the pitch movement is rising or falling. More significantly, perhaps, these two phonological systems of contrasting choices are described in terms which make "direct reference to the interactive process" - a process taken by Brazil to be "implicit in every spoken utterance." In this respect it is explicitly assumed that certain contrasts are "more central to the communicative process than others." (p.4).

Choices in TONE are seen as relating to the moment by moment convergence or divergence of the interpenetrating worlds of speaker and hearer. Rising tones represent an existential choice by the speaker

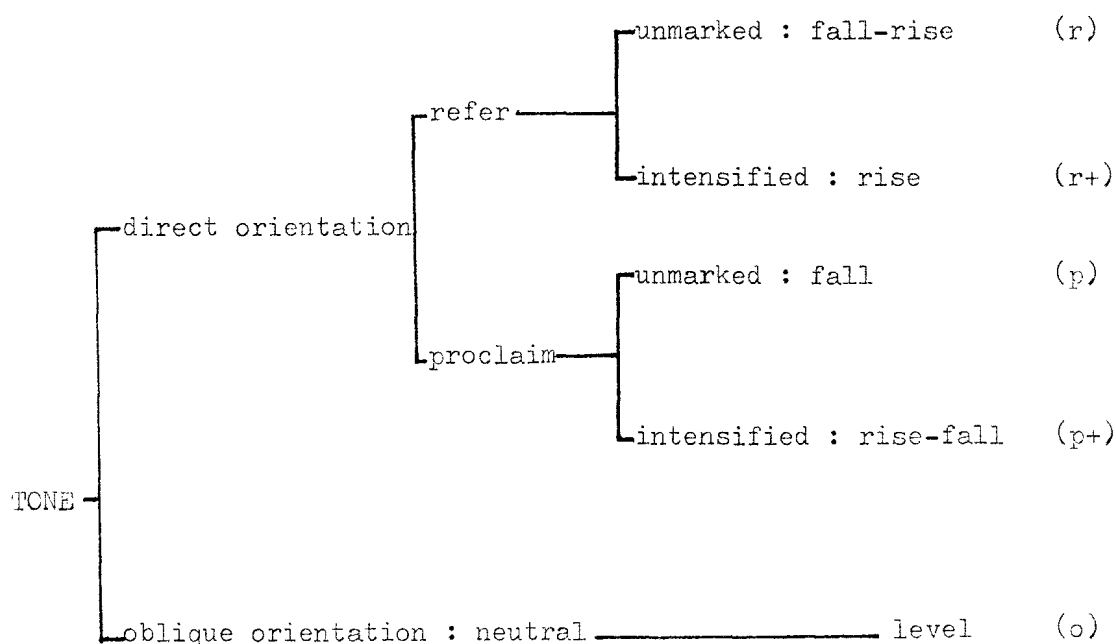


to treat the verbal text thus realised as part of the shared world of speaker and hearer; it treats the matter of the discourse as if it were already negotiated in interaction. These tones (the rise and the fall-rise) are labelled REFERRING.

Conversely falling tones represent a choice by the speaker to mark parts of an utterance as having "the status of information in that they are presented as if likely to change the world of the hearer". These latter tones (the fall and the rise-fall) are labelled PROCLAIMING.

Level tones represent the fifth choice in the tone system and these are considered by Brazil to embody a neutral choice, selected by the speaker at points when his focus is not on the interaction but on certain properties of the message itself such as its linguistic organisation. This oblique orientation might for example be used in 'quoting'.

We can summarise these choices diagrammatically as follows:



The second central system of which the tone-unit is the domain, namely KEY, contains three basic terms which are expounded by the

speaker's "potentially meaningful choice to pitch each successive tone-group at, above, or below the level which for him can be regarded as the norm" (p.10). Above the norm is termed HIGH KEY, below the norm is termed LOW KEY, and MID KEY of course refers to the norm itself. As regards the relationship between KEY and the interactive process we can say of HIGH and LOW KEY that "the former carries the implication, 'there is more to follow'; the latter, 'this is said in a situation created by something that went immediately before.' In discourse, we can say that one sets up expectations, the other has prerequisites."(p.10).

To relate intonation systems so clearly to the interactive process constitutes in itself a new departure, but Brazil's crucial innovation would seem to be the notion of KEY. For although KEY choice is associated with the individual tone-unit, Brazil argues that "there is a progressive stepping down in a lengthy utterance from one tone-group to the next." This feature leads him to define a higher ranking phonological unit having the structure

HIGH KEY	MID KEY	LOW KEY
(1....n)	(1....n)	(1....n)

This unit provides in effect an intermediate layer of structure between tone-unit and utterance. In Chapter II I termed this unit the PERIOD and in the following observations on prosodic patterning in lecture monologue it is seen primarily as one way in which MEMBERS are organised into either close or discrete discourse relationships. Basically it segments the chain of MEMBERS into discrete discourse units.

An important qualification needs to be introduced at this point. If PERIOD as a phonological unit is closely related to discourse organisation what then is the status of tone-unit? Does the latter also provide a resource for indicating discourse structure?

A rather circuitous argument suggests that this might well be the case. For tone-unit boundaries are in themselves difficult to isolate in absolute terms: from the analysts viewpoint their placement is heavily influenced by prior isolation of the tonic syllable. In section 6.0 below, however, it emerges that placement of the tonic syllable provides the speaker with a strategy for foregrounding what are informationally significant items for the purposes of the interaction. Thus, insofar as tonality is influenced by tonicity, it can be claimed that the former should ultimately be seen as an aspect of discourse.

Nonetheless there remains a large body of opinion and evidence to support the contention that tonality is related to syntactic considerations. Halliday's (1967) description of intonation rests on such an assumption insofar as he takes as his starting point "the syntagmatic equivalence of clause and tone group". Crystal (1975) claims that in the examination of 12,000 tone-units from spontaneous conversation all but 100 conformed to the rule that "placement of tone-unit boundaries is determined by syntactic structure". (p.15). And Collier and 't Hart (1975) cite experimental evidence to support the conclusion that "there is a strong tendency for intonational block boundaries and syntactic constituent boundaries to coincide." (p.119).

My own data supports at the very least the rather minimal assertion that, while a MEMBER may contain many tone-units, tone-unit boundaries rarely (if ever) transcend the boundaries of syntactically independent units. Indeed it is at the syntactic boundaries that tone-unit boundaries are most clear and incontrovertible. I would therefore argue that while TONE and KEY serve functions in the discourse, TONALITY is probably best seen as heavily influenced by syntactic factors. Indeed, this would provide indirect support for the contention that in lecture

monologue the discourse organisation builds more directly onto syntax than in other speech genres.

### 3. KEY AND DISCOURSE : DEFINITIONS

#### 3.1 KEY

Fundamentally the system KEY applies to the pitch level of the tonic segment of the tone unit. Previously it has been stated that the three terms in the system (HIGH, MID and LOW) allow for the speaker's choice of pitching the tonic segment at, above or below the level which can be considered for him to be the norm. In the light of the lecture monologue data, however, this is beginning to look too static a way of representing the ongoing use of pitch level in a continuous text. Lecturers for instance employ a 'shifting norm' in the moment by moment delivery of the monologue, and MID KEY at one point in the lecture is not the same pitch as MID KEY at another. It may therefore become necessary to see KEY choices not in terms of a continuous unchanging norm but as contrasting in pitch level with the immediately preceding tonic segment. Thus, in a series of tone-units A, B, C, D, if A is MID KEY then B is considered to be HIGH KEY if the pitch level of its tonic segment is significantly higher than A. If C is higher than B it remains in HIGH KEY. But if D is lower than C it will be seen as selecting MID KEY even though its pitch level may be closer in height to B than to A. This I believe to be Brazil's current position with respect to KEY.

While solving one set of problems, however, it creates another. Discussion of the prosodic shape of PERIODS later in this chapter draws

on an intuitive sense that the monologue resolves itself into 'blocks' of MEMBERS - 'blocks' which begin in HIGH KEY and end in LOW KEY following each other in succession as the discourse unfolds. But if the KEY choice of a particular tone-unit is analysed by reference to the immediately preceding tone-unit, then it follows that any step up in pitch level after an immediately prior LOW KEY tone-unit must be analysed as MID KEY. This would effectively preclude the usefulness of KEY in isolating PERIOD boundaries, the defining characteristics of which are held to be LOW KEY at conclusion and HIGH KEY at onset.

There are two complementary solutions to this problem. In the first place it may be argued that the resolution of PERIOD is effected not merely by KEY CHOICE but also by other factors. I shall in fact argue that PERIODS conclude not only in LOW KEY but also co-incidentally select a falling or proclaiming tone. Secondly, it is possible to produce a compromise definition of KEY whereby the KEY of a tone unit is determined by pitch height of the tonic segment relative to the height of the preceding tonic segment except after the selection of LOW KEY. After the selection of LOW KEY the KEY of the next tone-unit is decided by reference to the last tone unit in MID KEY. If the pitch level is higher than the last MID KEY tone-unit then the new tone-unit is in HIGH KEY and a new PERIOD has begun. This sounds a rather tortuous kind of definition but it has the merit of some kind of analytic consistency and proves easy to apply in practice.

### 3.2 TONIC SEGMENT

Tonic segments minimally consist of a tonic syllable but may have further constituents. Longer tonic segments contain pitch prominent

syllables preceding the tonic syllable. The first prominent<sup>1</sup> syllable of the tone-unit marks the onset of the tonic segment. Key choice in the tonic segment is expounded by the pitch level of the onset syllable. Non-prominent stretches within the tone-unit that precede or succeed the tonic segment are termed the proclitic and enclitic respectively.

### 3.3 TERMINATION CHOICES

In tone-units where the tonic segment is not coincident with the tonic syllable a secondary pitch choice is available at the latter. The tonic syllable in other words may be delivered at a different pitch from the onset syllable of the tonic segment. This secondary pitch level choice is called TERMINATION. TERMINATION, may be pitched at, above or below the level of the immediately preceding KEY choice which leads to a secondary, three-term system of HIGH, MID and LOW TERMINATION. Only one pitch step in difference is allowed between KEY and TERMINATION choices in a single tone-unit. A tone unit which contains a tonic segment including both pitch-prominent syllables and a tonic syllable may thus realise the following KEY and TERMINATION choices:

HIGH KEY ;	{ HIGH TERMINATION MID TERMINATION
MID KEY ;	{ HIGH TERMINATION MID TERMINATION LOW TERMINATION

---

<sup>1</sup> "prominence" is assigned by reference to a combination of factors such as increased stress, increase of pitch height relative to a prior non-prominent syllable, and increased duration.

LOW KEY ;                     $\left\{ \begin{array}{l} \text{MID TERMINATION} \\ \text{LOW TERMINATION} \end{array} \right.$

### 3.4 NOTATION

Prominent syllables are capitalised: (e.g. DIFFerent)

Tonic syllables (which are by definition prominent) are capitalised and underlined; (e.g. FUNCTIONs)

Tone-unit boundaries are denoted by a double slash or stroke thus //.

The tone of the tonic syllable is indicated by a single lower-case letter following the boundary at the onset of the tone-unit thus //r.

r indicates referring tone (fall-rise)

r+ indicates intensified referring tone (rise)

p indicates proclaiming tone (fall)

p+ indicates intensified proclaiming tone (rise-fall)

o indicates oblique or neutral tone (level)

Silent stress and short pause is indicated by a single dash -.

Transcription is set out on a three line stave representing the three pitch levels.

$\begin{array}{c} | \\ // \\ | \end{array} = \text{MEMBER BOUNDARY}$        $\begin{array}{c} || \\ // \\ || \end{array} = \text{PERIOD BOUNDARY}$

The following example illustrates most of these conventions. The first tone-unit is MID KEY; the second is MID KEY, HIGH TERMINATION. The first tone-unit selects proclaiming tone, the second selects referring.

H	<u>FUNCTIONS</u> //.
M	//p a <u>NUMBER</u> of //r <u>DIFFERENT</u>
L	

### 3.5 TEXTUAL ABBREVIATIONS

K = KEY

T = TERMINATION.

H, M and L = HIGH, MID and LOW respectively

Thus MK/HT = MID KEY/HIGH TERMINATION

CC = MEMBER = CLAUSE CLUSTER = Syntactically independent unit:

either a main clause, main clauses in a branched relationship

where a necessary element of structure is ellided from the

branched clause(s), or (a) main clause(s) and subordinate

clause(s)

T.U. = Tone-unit.

### 4.0 THE COMMUNICATIVE VALUES OF KEY AND TERMINATION VALUES

If the unmarked phonological structure for the unit PERIOD is from HIGH, through MID to LOW KEY, then departures from this form are assumed to have contrastive significance for the communicative process.

These communicative values seem to be of two main kinds which we loosely



term 'STRUCTURAL' and 'SEMANTIC'.

#### 4.1 STRUCTURAL VALUES OF HIGH KEY

PERIODS usually consist of more than one MEMBER. Occasionally however a single MEMBER may constitute a PERIOD. In such cases the MEMBER begins in H.K. and concludes with L.K. or with L.T. The following are three examples of single-member PERIODS.

Ex.1

OUT these other com  
r with PCNents //p this will NOT ACT as an  
AMPLifier //

Ex.2

FAR as the //p SIGnals //p+ the ALternating  
p as signals // r are conCERNed //

p ONLY those two com

PCNents // p are DOing useful  
WORK //

Ex.3

FAR as the // p+ BASic // p+ PROcess // p+ of AMPlifying // p+ a  
p+ but as.

SMALL SIGNAL //

r conNECTed onto THE - Input HERE // o is concerned // r

REALLY // c only two //

there are. p ELEments //pDOing any real AMPlifiCATION

SISTor it <u>SELF</u> //
// r the tran p and this reSISTor
HERE //

Where, however, a PERIOD contains more than one MEMBER, each new MEMBER is typically<sup>1</sup> marked by HIGH KEY. Thus HK is used structurally, not only to mark the onset of PERIODS, but also to mark the onset of MEMBERS within PERIODS. (see Examples 4, 5 and 6 below).

There is however another important structural use of HIGH KEY within the PERIOD. MEMBERS which are non-final in the PERIOD may also conclude in HK. The effect of this choice is to signal a special relationship between MEMBERS which are internal to the PERIOD. Where a MEMBER or CC. concludes in HK (or HIGH TERMINATION) then the ensuing MEMBER can often be seen as an expansion or exemplification of the first. (in a written text the juncture between the two might well be marked with a colon or semi-colon). Examples of this kind of relationship are given below:

Ex.4

r another class of <u>Amplifier</u> //	<u>WE</u>
p which shan't be //	r TALKing a great

<u>THIS</u>	<u>Power amplifier</u> //	o this is -
deal about	year //	r is the so-called

1. Some important exceptions to this rule are noted below in section 6.0.

the type of amplifier // essentially // signal  
p which is r a large amplifier

Current // Large  
// p dealing with fairly heavy p meant to supply power // p

to a LOAD // Motor // Loud speaker // n if  
o which may be a r or it may be a

its  
an AUDIO amplifier.

Ex.5

WAVE form //	PERiodic //	SIMplest
r the p+ may in FACT be	p the one // r+ of	

SINE  
COURSE // p is the WAVE //

Ex.6

AMPLifiers of course //  
now o can perform // p a NUMBER of N r DIFFerent

FUNCTIONS // Amplify // o WHAT are essentially - // p STEADY //  
p they can

---

r + VOLtages //

---

r or CURrents // o SOME TIMES //

---

Fortunately //

---

p and RATHER un

---



---

p D c // r+ AMPLifiers // p DI RECT // p CURrent // r+

---

p CALLed //

---



---

AMPLIFIERS // etc. - .

---

In each of these examples, if we consider the final tone unit of the first member, the tonic syllable falls within a lexical item to which subsequent lexical items in the following member stand in a relationship of inclusion or expansion.

e.g. In Ex.4 "POWer amplifier" is expanded to "large SIGnal amplifier"

In Ex.6 "FUNctions" includes or involves "(amplifying) // STEADY // VOLtages // ... etc."

In Ex.5 "PERiodic (wave form)" includes within its definition the "SINE WAVE"

Occasionally MEMBERS conclude in MK (or MT) and the example given below is particularly rich in this feature. (Members are numbered serially at their onset in order of occurrence.)

Ex.7<sub>(1)</sub>

---

TRONic circuits // p can BY and large //

---

p elec o be broken down into //

---



concludes in HK thus indicating a close relationship between it and the following member. This expectation is fulfilled insofar as CC.3 begins with the extended text reference item 'WHAT', interpretable by reference to much of the preceding MEMBER. CC.3, however - although syntactically independent - does not select HK at its onset. The reason for this may be that it is there only to provide the resolution of the PERIOD. Alternatively it may be seen additionally as a SUBSIDIARY GLOSS since many SUBSIDIARY members are delivered at a lower pitch than the surrounding discourse. (see below Section 3.0).

We may sum up the preceding observations as indicating that HK is used in a 'structurally contrastive' fashion to mark the onset of new MEMBERS and new PERIODS. It is also used in MEMBER final tone-units to signal a close discourse relationship with the succeeding MEMBER. A similar kind of close discourse relationship is signalled by MK (or MP) in MEMBER final tone units.

#### 4.2 'SEMANTIC' OR 'INTERNAL' VALUES OF HIGH KEY

HIGH key is selected not only after MEMBER and PERIOD unit boundaries. It is also selected within MEMBERS and PERIODS. In these cases its value is not so much one of 'structural' contrast but 'semantic' contrast. By 'semantic' in this context I mean that items containing prominent or tonic syllables in HK within a PERIOD or MEMBER (i.e. elsewhere than at a structural boundary) are thereby treated as if they were an antonymous member of a closed set which are seen as standing in contrast to the selected HK item. This represents an existential choice by the speaker: the relationship may not be antonymous in the strict formal sense - the speaker merely sets it up as if it were. The following

example illustrates this semantically contrastive or internal function of HK.

Ex.8.	(1)	(2)	(3)
r	aNOther class of <u>AMPlifier</u> //	<u>WE</u>	
		p which shan't be //	r talking a great
	(4)		
	<u>THIS</u>	<u>POWER</u> amplifier //	
deal about	year//r	is the so-called	

(Tone-units are numbered serially.)

In T.U. 2. WE is selected as if it were in opposition or contrast to

"other lecturers with the same audience". In other words 'this lecturer with this audience will not treat of power amplifiers, but other lecturers might do so.'

In T.U. 3. THIS is selected as if in opposition to "next" or "subsequent".

In other words power amplifiers may in fact be dealt with at a later stage in the course - not this year but in later years. (The lecture is being given to first year students).

T.U. 1 and T.U. 4 are in fact member-initial and member-final tone-units. Selection of HK is thus related to structural values of KEY choices. Nonetheless even in these instances semantic values are realised.

In T.U. 1. AMPLIFIER is selected as if it were in opposition to other

members of the set of items comprising ANALOGUE CIRCUITS; in other words AMPLIFIER as opposed to "frequency changer", "voltage regulator", "mixer", "feedback circuit", "ramp generator", etc.

In 1.0. 4. POWER selects Hk to signal its opposition to TRANSISTOR.

(Transistor amplifiers as opposed to power amplifiers will in fact be dealt with by this lecturer with these students this year).

In many cases, therefore, Hk realises both structural values and semantic values simultaneously.

We can summarise this section on HIGH KEY in the following terms:

- (i) HIGH KEY is used to mark the onset of PERIODS.
- (ii) The unmarked form of the PERIOD involves a progressive stepping down through the KEY system. Prosodic choices which cut across this basic pattern signal various communicative values. If Hk is again selected within the PERIOD it signals either:
  - (a) The onset of a new MEMBER ;
  - or (b), that the MEMBER thus terminated has a close relationship with the following MEMBER (in which case its value is comparable to the colon in a written text)
  - or (c), an existentially posed semantic contrast of antonymy or opposition; where (c) can operate simultaneously with (a) or (b).
- (iii) It has also been noted that MEMBERS can be closed with MID KEY or LOW KEY. In the case of the latter it thereby often closes a PERIOD. In the case of the former a similar relationship to (ii) (b) above is signalled.

#### 4.3 COMMUNICATIVE VALUES OF LOW KEY

LOW KEY is most typically associated with the closing of a PERIOD. PERIODS are closed whenever LF or LOW INTENSIFICATION occurs with a MEMBER final tone unit, the immediately subsequent tone unit being HIGH KEY.



Accordingly, a LK//RP sequence of tone-units at a MEMBER boundary can be seen as mutually defining a coincident PERIOD boundary. Occasionally the final tone unit of<sup>a</sup> PERIOD selects LK at the onset of its tonic segment but a further pitch-level choice at tonic syllable produces a MID TERMINATION. Functionally or communicatively this is considered to be the equivalent of LK or LP period final tone units. (Considerations of TONE enter in at this point: typical tone selection for PERIOD final tone units is proclaiming. The step up from LK to MP can be seen as phonologically motivated in order to produce a clear falling tone.)

Pitch-level choices for period-final tone units can thus be summarised as follows:

LOW KEY / LOW TERMINATION

MID KEY / LOW TERMINATION

LOW KEY / MID TERMINATION

These pitch-level choices are illustrated in the following examples.

Ex.9 LOW KEY / LOW TERMINATION

PROBABly //  
WHICH is p SINuSSOIDal //

Ex.10 MID KEY / LOW TERMINATION

p CIRcuits // o that perform // p CERtain specified  
FUNctions //

Ex.11

FUNctions // p which ONE can  
p of these iMAGine //

Ex.12

INput //  
p on the sort of p WAVE forms // p that WE can  
APply //

Ex.13 LOW KEY / MID TERMINATION

p during the LECtures //  
COURSE of the er -

Ex.14

p you can RAPidly exPAND // WELL //  
p INto the OTHers as

All of these examples are considered to be functionally equivalent - if phonologically variant-ways of closing PERIODS. There may in fact be a correlation between different termination choices and the syntactic resolution of the CC. MID TERMINATION would seem to be associated with the ADJUNCT element of clause structure where it occurs in CC-final position. (see, for instance, examples 13 and 14 above). LOW TERMINATION, however, tends to be associated with the final part of clauses acting as either post modifiers or as Bound Adding clauses (i.e. relative clauses of both the restrictive and non-restrictive variety) where these occur in CC-final position. (See examples 9-12 above). This is especially so where the last item is the lexical element of the verb, as exemplified below, and in Ex's 11 and 12 above.

Ex.15

p and THOUsands // o of different // p opeRations // p which Allologue

---

---

---

---

circuits // p can perIOD

---

---

LOW TERMINATION is also associated with appositional elements,  
as in the following instance.

Ex.16

---

---

o and amplifiers // p of - steady p D C

---

---

VOLTages // AMPLifiers //

---

---

In noting these syntactic correlations it is not being claimed that grammatical choices are determining KEY and TERMINATION choices. It is more likely in fact that these particular syntactic structures are selected as an appropriate way of achieving PERIOD closure insofar as they allow further non-crucial information to be "tagged on" at the end of the period. This observation relates to a further communicative value of LOW KEY which can be seen as the obverse of HK's contrastive value. Brazil (1975) states that: "medially, and at the end of an utterance, low key tone groups are generally uninforming". In selecting them, "the speaker exploits the possibility of alternative formulations of what, from the point of view of both participants, can be regarded as the 'same' matter". (p.21). LOW KEY therefore can be seen as having an 'equative' function. As with HIGH KEY the semantic value can overlap with the structural connotations of the KEY choice: the two may coexist together or the semantic value can occur independently of period-closure. Not all LOW KEY or LT tone-units close PERIODS of course: for this to be accomplished the onset of the next MEMBER (in effect the immediately subsequent T U) must be in HK. Where however LK or LT tone units do not take an immediately subsequent HK tone unit they can nevertheless



at a particular moment in an on-going relationship". (p.6) In lecture monologues there is some peculiarity about the use of this tone since it is often used in the realisation of lexical items not previously mentioned in the discourse. Conversely proclaiming tones are often used with items already negotiated in the discourse. Referring tones of course can be used "to mark matter which the speaker wishes to insinuate into the situation as if it had already been negotiated" (p.7.) and one would not be much surprised at this tactic appearing as a basic feature of lecturing technique. Nevertheless not all cases of apparently anomalous use of referring tone can be explained in this way. In the following extract both asterisked lexical items appear for the first time in the lecture and both are explicitly marked respectively by the phrases "what is known as" and "so-called" as not necessarily part of the shared knowledge of speaker and hearer. They both however appear with referring tones.

Ex.18

p this is WHY // MAIN // p CONcentrate  
p we SEAL - in the // o on dealing  
with // r what is known as \*SINusoidal excitations\* // p SIN wave //  
// r another class of AMplifier // WE  
p which shan't be // r  
p SIGnals //  
THIS \*POWer amplifier\*//.  
talking a great deal about year // r is the so-called.

It depends of course on whom we take to be the lecturer's audience at this stage in the lecture. The sensitive lecturer probably does not perceive his audience as an undifferentiated mass but as discrete groups with varying levels of knowledge and competence in the subject area. In addition he is also probably conscious of a kind of "court of expert opinion" - of how specialists in the field would formulate the same matter amongst themselves. He therefore has the problem of conforming to the requirements of the discipline's internal logic and at the same time gauging his utterance to meet the varying capabilities of individuals in his audience. This may lead him to trying to 'have his cake and eat it', so to speak, by simultaneously marking content as new with the use of a preface and signalling that some will have heard of it already by use of referring tone. One thing is certain: for any lecturer, especially when confronting new students, the problem of 'shared knowledge' is acute. And in most lectures the problem is exacerbated by the fact that the situation inhibits anything but the most minimal feed back. In the preparation of this study it was thought that the interplay between referring and proclaiming tones might throw some light on patterns of lexical cohesion in lecture monologues. But selection of these tones certainly does not correspond to any simple definition of 'given' and 'new'. The existential definitions 'referring' and 'proclaiming' only raise the problem of shared knowledge outlined above. Consequently I would argue that the referring/proclaiming distinction as an analytic resource and as a speaker's strategy may well prove to be a feature specific to multi-party talk rather than to uninterrupted monologue. Where the actively shared negotiation of meanings is absent and where, in effect, there is little 'shared knowledge', then falling and rising tones may not carry the communicative values of proclaiming and referring.

What value they do carry in this situation is probably of a more primitive order. We have already noted that period-final tone units almost invariably co-selected falling tones. By contrast the low-rising or level tone most frequently occurs at points where syntactic considerations indicate the CC. or MEMBER to be incomplete, as in the following example (The end of E U's selecting neutral tone are marked by an asterisk).

Ex.19

POF THIS slide up //

// o NOW \* // r I've o to show you where\* // r what

I'M going to //

o talk about \* // p COMES

IN //

(The low rise or level tone is indicated by zero in the transcript).

Ex.20

AMPLifiers //

o there are o there are frequency CHANgers // o voltage

REGulators // o mixers // o feedback circuits // o ramp generators

The value of the neutral tone seems therefore to be as a marker of incompleteness: it has a clear sense of implying further continuation of the utterance or discourse unit within which it occurs. The rising tones themselves seem particularly to be associated with non-finality

though unlike neutral tones they can occur at points of possible syntactic resolution, e.g.

Ex.21

HAPS the most <u>im</u> PORTant one //		
r it's per		o and // p if you've got a <u>GRASP</u>
of that //	<u>PECT</u> //	
// o	r+ parTICular as	r of ANalogue circuit <u>DES</u> ign // p
you can RAPidly ex <u>PAND</u> //		
		<u>WELL</u> //
p INto the OThers as		

This general picture of tone values corresponds with Delattre's (1966-7) findings for French of which he says: "whereas finality contours are falling, continuation contours are rising" (see Bolinger, 1972, p.167). (It would in fact provide one means of explaining why rising contours are heard as questioning in interactive discourse.) The notion of rising tones as continuative is also supported by Crystal's (1969) statistical work on the tone sequencing, concerning which he remarks that: "the linguistically more interesting tones that exert an influence on anything which follows are the rise and the fall-rise." (p.242). Their higher degree of predictiveness thus reinforces their continuative potential.

One has to be careful however in applying these generalisations indiscriminately in analysis. Not all proclaiming (falling) tones register finality. In some data for instance they constitute as many as



two out of three tone units (see Crystal, 1969, p.225). It would seem in fact that the continuative & finality contrast becomes particularly important insofar as it interplays with the possible completion points of MEMBERS and of PERIODS. Such points are asterisked in the following example. It is noticeable that the majority of such points co-select straight rising tones in the tone unit terminating with the asterisk.

Ex.22

	AMPlifiers of course //
r now .	o can perform // p a <u>NUM</u> ber of // r <u>DIFF</u> erent
<u>FUNCTION</u> s*//	<u>AMPlify</u> // o <u>WHAT</u> are <u>eSSENT</u> ially - // p <u>STEADY</u> //
	p they can
r + <u>VOLT</u> ages*//	
	r 'or <u>CUR</u> rents*// o <u>SOMET</u> imes // <u>FORT</u> unately //
	p and <u>RAT</u> her un
p <u>CALL</u> ed p <u>DC</u> // r + <u>AMPlifiers</u> *// p <u>DIRECT</u> // p <u>CUR</u> rent // r + <u>AMPlifiers</u>	
*/ - // o what it means is its <u>AMPlify</u> ing - // p a <u>STEADY</u> //	
	p <u>VOLT</u> age //

It would seem therefore that at points where syntactic predictions have been exhausted but where the speaker wishes to continue the MEMBER or PERIOD he marks its non-closure by selection of rising tones, implying

that there is in fact more to follow.

## 5.2 TONE: SEQUENCING

Though tonal sequencing does not seem to play a crucial role in the organisation of the discourse there are one or two instances worthy of note. One obvious type is that associated with listing. These usually involve selections of neutral tone, the continuative properties of which help to establish the series as a list in which no one item takes precedence over another. Closure of the list typically involves selection of proclaiming (falling) tone, e.g.

Ex.23

AMPlifiers //

o there are . o there are frequency CHANGers // o voltage

REGulators // o mixers // o feedback circuits // o ramp generators // p

and THOUSands // o of different // p opeRATions// p which ANalogue

circuits //

p CAN perFORM //

Another type of tonal sequence involves the repetition of lexical items in an identical syntactic form realised through repetition of

referring (rising) tones.

Ex. 24

THIS // r + or THIS // r + or THIS //

r + such as .

EX. 25

r of THREE F one // r and then FIVE F one // r and SEVEN F one //

In these cases lexical and syntactic parallelism seem to give rise to a consequent tonal reduplication.

More sophisticated examples of tonal parallelism are represented by the following where pairs of contrasting tones are repeated in sequence.

Ex. 26  $r + \quad | \quad p \quad p \quad r +$

~~p DC // r + Amplifiers // p DIRECT // p CURrent // r + AMPLIFIERS //~~

$\frac{p^{27}}{p} \frac{p}{p} \frac{r +}{p}$   
Difference between // p SMALL signal //

p the ... r + AMPlification // p and

$$r +$$

LARGE signal // r + AMPLification

Tonal parallelism such as this seems to be associated with instances of verbal repetition with expansion (example 26) or repetition with contrast (example 27).

There are however examples of what seems to be tonal parallelism with no accompanying lexical or structural repetition, as in the following.

Ex. 28

r + | p r +

p you want to Amplify // Signal // p and USE it // r +

r + THIS very SMALL

in SOME WAY

The distinctive characteristic of this example is the manner in which the second part of the sequence contains a high proportion of items which require lexical realisation elsewhere for a more complete interpretation. There is, for example, the pronominal reference 'IT' and the generalised noun phrase 'SOME WAY' containing a non-specific deictic. The stretch is in an additive relationship with the preceding discourse but the amount of new information specified to any degree is low. All these considerations would support interpreting this stretch as a kind of dummy item which repeats the sense of the first part only in a more generalised form. (To 'amplify a very small signal' is in fact to 'use it in some way'). The repetition in the second part of the sense of the first part enables us to see the tonal parallelism as motivated even though it is not accompanied by any lexical or structural repetition.

It may in fact prove to be the case that tonal reduplication and parallelism represents a very short domain 'chunking' of the message content. It is difficult however to extend these notions very far, since even in the examples given above the selection of rising tones

may be explained adequately in other terms (for instance as 'contin-uatives') just as much as by referring to the requirements of strict tonal sequencing.

## 6.0 TONICITY (AND LEXICAL COHESION)

Placement of the tonic syllable seems to play an important role in singling out lexical items with a high information load.

In lectures we can make a crude distinction between two kinds of vocabulary - specialist vocabulary and general vocabulary. Like the distinction between grammatical items and lexical items this distinction is best seen not in terms of a binary opposition but in terms of polarities on a cline running from items restricted to the discourse of electronic engineering on the one hand to items of general usage on the other. The specialist vocabulary would include such items as "frequencies", "sinusoidal excitations", "periodic", "current", "voltage", "analogue circuits", etc. The general vocabulary may be exemplified by such items as "concentrate", "fact", "smaller", "tone", "action", "response", "main", etc.

There are of course a number of problems attendant upon this twofold division. Items from general usage are taken up and used with a specialist sense in this context, e.g. SIGNAL as in "sinewave signals", WAVE as in "periodic wave form" or LOAD as in "meant to supply large powers to a load which may be a motor or it may be a loud speaker". Other items in fact may be developed especially for use in this context but then pass into general currency to be used in a less specialist and restricted sense, (e.g. "amplifier" or even "transistor"). One mark of this kind of

introductory lecture is progressive redefinition of items in more and more restricted terms by various forms of pre and post modification and by various forms of relative clauses. Thus "circuits" is variously modified as "electronic circuits", "analogue circuits", "digital circuits", "feedback circuits". "Amplifiers" is variously modified as "analogue amplifiers", "direct current amplifiers", "amplifiers of sinusoidal signals", "power amplifiers", "amplifiers for amplifying sinusoidal signals - AC signals - alternating current".

As the lecture progresses basic terms or items become more and more restricted in their definition. Where an item is treated in this fashion I take it to be part of the specialist vocabulary even though there may be some initial ambiguity as to its position on the cline.

If we consider 120 consecutive tone units from the opening of a lecture we discover that about 44% of tonic syllables are part of the realisation of specialist vocabulary items and about 50% are part of the realisation of non-specialist vocabulary. This kind of placement of the tonic is not in itself unusual if we take into account the known tendency of tonic syllables and stress to fall on lexical rather than grammatical items. (See Crystal, 1969, p.267). If we concentrate on the specialist vocabulary alone, however, we discover that as much as 90% of specialist vocabulary items take tonic syllables in their realisation and where a specialist term does not itself take a tonic syllable it is usually occurring as part of nominal group containing a tonic syllable elsewhere in its structure. (e.g. "SINUSOIDAL" in // p SINusoidal SiGnals //).

Furthermore not only does the occurrence of specialist vocabulary tend to coincide with placement of the tonic syllable but lexical

repetition tends to take place in terms of members of this class rather than with general vocabulary items. The same 180 consecutive tone units contain 9 repetitions of AMPLIFIER as tonic, 6 of CIRCUIT, 6 of SINE, 5 of ANALOGUE, 6 of SIGNAL, 4 of AMPLIFY.<sup>1</sup>

This is in contrast to general vocabulary items which are subject to a much lesser degree of repetition. In the same stretch, for instance, the highest degree of repetition pertains to the items NUMBER (3 times), FUNCTION (3 times), and SMALL (3 times).

Not only therefore does a higher proportion of specialist vocabulary items tend to take tonic than general vocabulary items, but specialist vocabulary items also tend to be subject to much more reiteration. In broad terms we can say that the role of specialist vocabulary items in creating texture through lexical cohesion is much greater in this kind of text than the role of general vocabulary items. And 'foregrounding' of this informational strand through the text is accomplished by placement of tonic syllable.

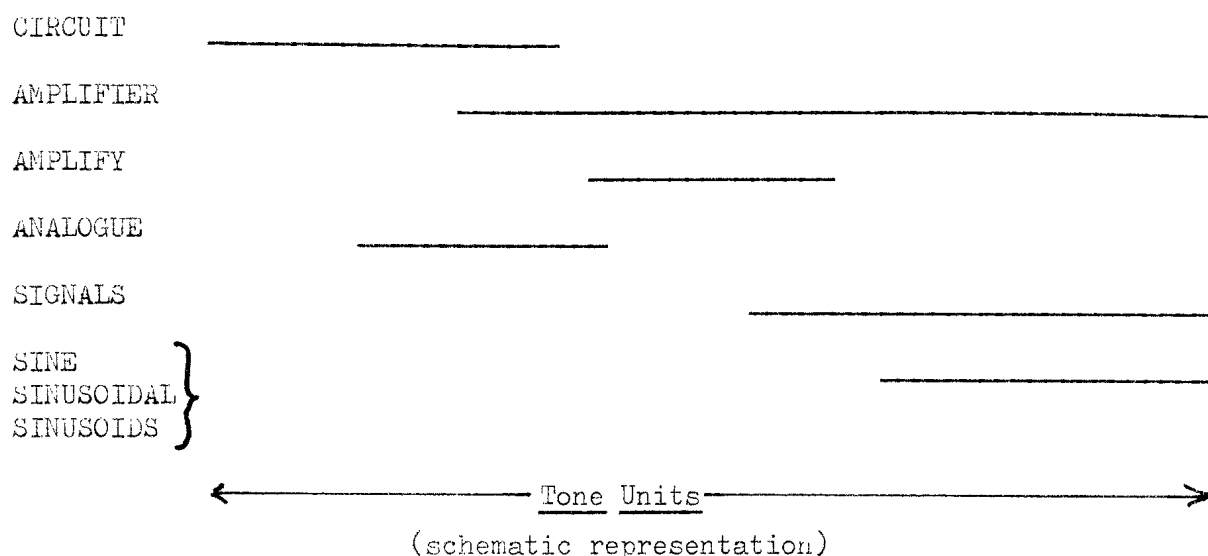
Intuitively it might seem that development and replacement of topics within the text might be signalled in part by repetition of particular specialist vocabulary items as tonic. However, various problems arise if we try to apply this insight rigorously and systematically to the text.

Firstly, repetition in the text of one item is not replaced by repetition of another item in a sequential and orderly fashion. Different items are subject to repetition "in parallel" as much as in sequence. We may represent this for select items in the course of

---

<sup>1</sup>. It is noticeable in this respect that however many times an item is repeated it is still more likely to take proclaiming rather than referring tone. (Sec 5.1 above).

160 tone units schematically as follows :



Secondly, the meaning of items changes subtly according to their context of use and there tends to be progressive redefinition of the meaning of an item as the lecture proceeds (cf. p.159 above). Just as in multiparty talk, topics are negotiated - speakers either converging or diverging in their negotiation of topic similarly in monologue discourse the meanings of items (which singly or in combination with other items may constitute the topic of a portion of text) are negotiated as the text unfolds.

Sometimes this may be done quite explicitly as in the following examples.

1 /Direct current amplifiers - what it means is it's amplifying a steady voltage - .../

2 /..AC signals - alternating current / this is a misnomer / to say it's an alternating current voltage - as so many people do of course - is a bit of a nonsense / erm we all do it so I'm afraid that I'm going to have to use this rather loose terminology / I hope you'll know what I mean / I mean a periodically time varying signal which is probably sinusoidal /



More often than not redefinition of terms and negotiation of meanings is left implicit in the unfolding of the text - a process to which the following remark gives testimony :

"the difference between small signal amplification and large signal amplification I hope will become clear to you during the course of the lectures".

This process is continual and its dynamic and overlapping nature makes it difficult to utilise series of repetitions of a particular item as a sole indication of a TOPIC or EPISODE. Nonetheless - despite these cautionary notes - it would seem highly significant that specialist items subject to a high degree of repetition and tending to take tonic syllables are in fact those items which tend to figure prominently in that focusing activity which can clearly be isolated in the same series of 180 tone units - as may be seen below.

FOCUS (PROSP)

1. "I'm going to talk about electronic circuits"

FOCUS (PROSP)

2. "We shall be talking about essentially analogue circuits"

FOCUS (RETROSP)

3. "So we shall be concentrating on amplifiers - analogue amplifiers"

FOCUS (RETROSP)

4. "So the amplifier may be called upon to amplify time varying signals."

FOCUS (RETROSP)

5. "This is why we shall in the main concentrate on dealing with what is known as sinusoidal excitations - sine wave signals."

The items underlined - viz. CIRCUITS, ANALOGUE, AMPLIFIERS,

AMPLIFY, SINE (SINEUSOIDAL) and SIGNALS - are in fact identical with those that constitute the list of repeated specialist vocabulary items typically taking tonic which is given on p.160 and again on p.161.

## 7.0 TONICITY AND DISCOURSE

If tonicity is a way of signalling those items which are semantically important, then where we find a high proportion of syllables taking tonic it is probable that the passage in question is rich in information. Conversely, where a low proportion of syllables take tonic then the passage in question is likely to be "non-topical" or a digression from the main discourse.

Various problems concerning measurement arise when we try and prove this generalisation in practice.

It depends, for instance, whether there are a large number of monosyllabic or polysyllabic words in the stretch where counting takes place, since no matter how many syllables a word contains there will only be one tonic. Accordingly a stretch containing a large proportion of polysyllabic words will give a low proportion of tonic to non-tonic syllables, even though each word may take tonic - hence implying that it carries an important semantic load.

It also depends, of course, on where we begin and finish counting, or on what criteria we isolate the unit or "stretch" for measurement. Nonetheless the general picture of tonic syllable rate variation emerges fairly clearly if we compare two sets of examples.

Ex.29/A Stretches with a high ratio of tonic to non-tonic syllables

Amplify // What are essentially - // p steady // r +  
// r they can

Voltages //

r or Currents //

Ex.30

r OR // (pause) // o we MIght // r a SMall // p but time  
r + Amplify //

Varying //

p Voltage //

Ex.31 /B Stretches with a low ratio of tonic to non-tonic syllables

n This is a misNOmer //

to Say its an Alternating Current Voltage // p an

AC Voltage // as so Many people DO of COurse is a Bit of a NOsense //

All DO it //

o Exh. // we

r so I'm afraid that I'm going to have to use this rather loose terminology

// p I HOPE you'll KNOW p I MEAN - PERiodically time Varying  
that I MEAN //

PROBABLY //  
SIGNAL // r which is p sinusOIDal //

Ex.32

r aNOTher class of AMPlifier // p which WE  
.. shan't be // r TALKing a great

THIS year // POWer amplifier // o this is -  
deal about r is the so-called

the type of amplifier // o which is esSEntially // r a large SIGnal

amplifier CURRent // p meant to supply  
// p DEALing with fairly heavy

LARGE powers //  
to a LOAD //

As a crude indicator of the tonic syllable rate, the sum total of syllables in a passage was divided by the sum of tonic syllables. This gave a ratio for A passages of 1:3.5 and 1:2.5 respectively (rounded off to the nearest half point). For B passages the ratios are 1:8.5 and 1:7.5 respectively.<sup>1</sup>

In general terms I would argue that tendencies towards a high tonic syllable rate (per no. of words or per no. of non-tonic syllables) is associated with main discourse whereas a low tonic syllable rate is associated with subsidiary discourse.

This feature overlaps with another parameter of prosodic investigation, namely that of tempo. Here again it is difficult to treat tempo in systematic terms<sup>2</sup> but it seems intuitively apparent that main discourse sections are delivered at a slower tempo than subsidiary discourse. Glosses or asides, on the other hand, are often delivered in an accelerated tempo. In this respect the two parameters of tonicity and tempo seem to exert a reciprocal influence on each other : acceleration of tempo being associated with reduction of tonic syllable rate and vice versa.

A similar observation is made by Crystal (1975) though he is more positive in identifying tempo as a determinant of other intonational contrasts:

"In output, variations in speed, rhythm loudness etc. often reduce, subordinate or eliminate many of the intonational contrasts. The most important variable here is speed,

- 
1. If we measure the proportion of words taking tonic syllables then we get 1:2 and 1:1.5 for A passages, and 1:6 and 1:4.5 for B passages. This seems to confirm the general picture of tonic syllable rate variation.
  2. Crude time measurements are inadequate since high speed of articulation can easily be interspersed with lengthy pauses.

whereby increased speed of utterance reduces the number of tone-units in an utterance, and vice versa ... Conversely, in input, one might expect initial processing of speed, loudness etc. to take place as a preliminary to more detailed processes" (p.15: my underlining).

If Crystal is correct in assuming speed to be processed before such features as tone, tonicity and pitch then the correlation between accelerated tempo and subsidiary discourse may prove important in the audience's initial estimation of the degrees of relevance of the unfolding discourse.

#### 8.0 FURTHER PROSODIC FEATURES OF SUBSIDIARY DISCOURSE

Besides acceleration of tempo and decrease in tonic syllable rate there seems to be a tendency to deliver an ASIDE or GLOSS in a lower key than the preceding or subsequent discourse. This is particularly true of parenthetic asides of the type that that can be seen as 'insertions' in the discourse. As Crystal remarks in The English Tone of Voice, (1975): "a stretch of utterance can be articulated as 'parenthetic' if it is given low pitch range with optional piano loudness and allegro tempo" (p.11). Longer asides or glosses, however, tend to have a stretch in low key near their onset but lengthy continuation of them tends to result in a gradual upward gravitation towards the key characteristics of main discourse. This feature can be seen in Examples 33 and 34.

Ex.33 (Asides or Glosses are contained within curly brackets)

---

Amplifiers of course //  
r now o can perform // p a NUMber of // r DIFFerent

---

FUNCTIONS // AMPlify // o WHAT are esSENTially - // p STEADy //  
p they can

r + VOLtages //  
r 'or CURrents // } o SOME TIMES // FORTunately  
p and RATHER um

// p D C // r + AMPlifiers // p DIRECT // p CURrent //  
p CALLed // r + AMPli-

STEADy //  
FIERS // - // o what it means is its AMPlifying - // p a p VOLtage

r OR // - // o we LIGHT // r a SMALL // p but  
// - // } r + AMPlIFY //

time VARYing //  
p VOLtage //

Ex. 34

p I shall be concentrating MAINly //  
r on AMPlifiers // o for - AMPlifying

r Sinusoidal signals // r C  
// A signals // r Alternating } p this is  
Current //

a misNCher //

p to say its an Alternating current Voltage // p an AC

Voltage // o as so many people do of course // r is a bit of a NAsense //

ALL DC

o ERN // p we it // p so I'm afraid that I'm going to have to USE

Terminology // p I HOPE you'll KNCw what I

this // r rather LOOSE

MEAN //

p I MEAN a periodically time Varying

PROEably //

SIGNAL // r which is

p sinusOidal.

One crucial distinguishing prosodic feature in this respect is the failure to mark new syntactically independent units with High key initial F.U. (cf. "what it means..." in Ex.33; also "I hope you'll know what I mean..." and "I mean a periodically..." in Ex.34). Normally every new syntactically independent unit is marked with a HK initial tone unit. In broad terms it would seem that the natural tendency to



raise voice pitch for each new independent syntactic unit is being resisted even though Hk is occasionally selected if the ASIDE or GLCSs continues through successive MEMBERS.

The discourse immediately subsequent to the subsidiary stretch tends to include a conjunctive item such as OR or BUT<sup>1</sup> at its onset and this in turn tends to occupy a full tone unit and also tends to be pitched slightly higher than 'normal' high key. (In Crystal's terms it might be seen as a high or extra high "booster") (1969 p.145).

## 9.0 THE STRUCTURE OF PERIODS

On the basis of the foregoing discussion of the formal properties of PERIODS (see especially sections 4 and 5.1 above), It should now be possible to specify some kind of ordering for constituent MEMBERS. Essentially the question is how one MEMBER "follows another in rational rule governed manner". Winter's paper on clause relations (1977) mentioned in Ch.II above is of obvious relevance in this context since the avowed aim of his work is to show

"that what enables us to communicate with each other in a rule-governed manner is that we share the meanings whereby we interpret an infinite number of sentences in their immediate context on the same principle that we share the semantics and grammar of the clause". (p.5)

More specifically Winter claims that successive clauses are related to each other by a closed system type of underlying semantics.

---

1. 'AND' has not been found as a conjunctive item used in the resumptive of main discourse. The simple additive relationship may be seen as confusing at a juncture where the speaker wishes to distinguish the new piece of discourse from that immediately preceding. He, therefore, tends to select alternative additive or - more commonly - the adversative relationship for contrastive effect.

Consequently clauses connect with each other in "strictly predictable ways." (p.35) Without such predictability the interpreter of text would be faced with potential chaos.

Furthermore not only are successive clauses related to each other by a closed set of underlying relations but such relations can be signalled in an anticipatory fashion by a finite set of lexical items. These in turn constitute a 'closed set' or 'vocabulary' whose function is to point not so much towards the world but towards the text itself. Examples of this vocabulary are such items as 'condition', 'contrast', 'difference', 'effect', 'function', 'result', 'structure', 'technique', 'way'. These items in effect are often superordinate terms which require lexical realisation elsewhere in the text for a fuller understanding.

In Chapter II we pointed out that in lectures such items can operate retrospectively in summing up the direction of the previous discourse. Winter in fact makes the more substantial claim that in written text they signpost the subsequent direction of the discourse by indicating in advance how successive units are related in terms of one or other of the underlying closed system semantic relations: the predictive items 'cue-in' the reader on what clauses to take together and on how to interpret their relationship. From our point of view it would be highly satisfying if we could draw a close analogy between the kinds of anticipatory organisation noted by Winter in written text and the unfolding of spoken monologue.

One particular problem however arises immediately. The emphasis in Winter's work is on interpretation rather than structure and thus little attempt is made to give a precise description of the discourse units to which his description applies. Four terms -

clause, sentence, member and paragraph - are employed, but the precise relationship between them remains unclear. 'Sentence', for instance in the discussion of examples is orthographically defined. Otherwise, "the terms sentence and clause are interchangeable." (p.6). The term 'member' "stands for one part of two-part membership, rather than for a sentence in a one-to-one relation with another sentence" (pp.2-3) so 'members' may each consist of one or more sentences. 'Paragraph' on the other hand is used "to describe the relation between two or more adjoining sentences in written language." (p.2.fn.) But, "the whole question of what is a paragraph needs to be re-defined" (p.2.fn.).

Nonetheless if we turn to the monologue data we do find instances of lexical items operating in a similar predictive fashion to those isolated by Winter in written text. In this respect it is particularly interesting that in many cases the prosodic configuration resembles the form noted earlier in section 4.1. Where we suggested that it signalled something like a "colon" relationship. If we consider Ex.6 above we find that the first MEMBER (in our terms) contains two of Winter's predictive lexical items: namely, 'different' and 'functions'. In this particular context the lexical realisation of the items is not already given in the text. It is therefore predicted. And significantly the MEMBER containing these items concludes in HK - a feature which in itself sets up expectations that more is to follow. There are other examples in the data as we can see below: (predictive items are enclosed within square brackets).

p + NOW there's a [General Term] //  
r which we er USE // r + in con-

SEPals // p the SEPals // r are collectively //	
MMSEction with the	o reffered

to // p as the p of the fLower // - //

In Example 35 we can see the second MEMBER as answering a question posed by - or derivable from - the first MEMBER. More specifically the item "a general term" anticipates or predicts subsequent lexical realisation in the following MEMBER. It is noticeable again that the final tone-unit of the first MEMBER selects HIGH KEY and referring (or straight-rising) tone. Furthermore the Example stands as a self-contained PERIOD. It would be tempting therefore to construe PERIODS as consisting fundamentally of a two part structure, something like OPENING and ANSWERING MEMBERS.

A further Example however will illustrate some additional complexities.

Ex. 36

// o the // [ p deGRATE of ] // GIDity //

p U<sup>n</sup> ri p of the conNEction //

Alther // r [ can VARY ] // r + according  
 p of the Filament // r to the

PLANT // r or to the r VERY  
 to the FLOWer // Often // p the ANTHER is

RIGIdly // r + aFFIXed // r + aTTACHed //  
 // p er pretty r + to the TOP

FILament // p but in SOME //  
 of the r FLOWers // r NOtably again its

REJECTION // LAX //  
GRASSes // p er the co p is er RATHER o so THAT //

r the ANTHER can MOVE // r Very freELY //  
 o on TOP // p of - the - FILament //

Here again we have the familiar prosodic shape for a first LEADER which somehow predicts the remainder of the PERIOD (There is a slight variation here insofar as the RA, straight-rising tone-unit, "according to the plant" is followed by another tone unit which selects MID DECLINATION. It sounds in fact like an afterthought or a slight qualification or even perhaps a performance error). The remainder of the PERIOD which 'lexically realises' "vary" (and also possibly "degrees") consists however of two LEADERS. These two subsequent LEADERS taken together in fact

expound what Winter calls a MATCHING relation whereby things, actions or people are compared "for same (similar) and different". They should, it would seem, be taken together as a single unit.

Accordingly, although it would still be possible to argue that PERIODS have a two part structure of OPENING and ANSWERING, we no longer identify each part with a single MEMBER. To sustain a two part structure for PERIODS we would have to posit a further intervening layer between MEMBER and PERIOD. We could call such a layer MOVE and argue that a PERIOD is made up of an OPENING MOVE and an ANSWERING MOVE each of which in turn may comprise one or more MEMBERS.

However, the problem turns out to be yet more complex as we can see from the following example.

Ex. 37

p NOW // SHOWN //

o erm // p + I've er r these on the er aGAIN

	[SEParate <u>STRUCTURES</u> ]	//	<u>IS</u> //
the DIAGram //	r as		p er it r

POSSible // r and often HAPPens // o THAT erm // p + there is

SOME deGREE of <u>FUSion</u> //	WHEN this
r + of <u>STAMens</u> //	r but <u>ocCURs</u>

ONLY re <u>LEAs</u> s to // p the <u>Filaments</u> //	<u>DON'T</u> get //
// p it	p you

p + the <u>ANTHERs</u> //	// p ONLY the <u>Filaments</u>
r <u>FUSing</u> to <u>GETHer</u>	

<u>ORER</u>	
// o and HERE a <u>GAIN</u> //	p the de // r of <u>FUSion</u> // p can

<u>VARY</u> //	

Here again the first MEMBER of a PERIOD ends in HIGH KEY with a rising tone and simultaneously sets up predictions that more is to follow through the hyponomic term "(separate) structures". Once

again the following MEMBERS expound in more detail the meaning of the hyponym. This time however three MEMBERS are involved and even then the PERIOD does not close but continues with "and here again" etc. This continuation in fact looks like another 'OPENING' with the phrase "the degree of fusion can vary". If this is so it suggests yet another layer of structure between MOVE and PERIOD.

Analysis along these lines begins to look increasingly complex and unwieldy. Moreover although the end of one lecture is particularly rich in this kind of patterning (see Appendix pp.A39-42 from where the above 3 examples were taken) I have not noticed it to anything like the same degree in other parts of the data. This would suggest that it may in fact prove to be a particular rhetorical or stylistic device of one lecturer dealing with content of a particular kind.

The notion of these kinds of periods being rhetorically 'structured' indicates perhaps why such a feature is more common in the written text analysed by Winter than in the lecture data. For the obvious major difference between the speaker and the writer is that the latter has far more conscious control of the text he creates. The lecturer who speaks extempore is limited in the kind of fore planning he can effectively undertake as he talks, and of course he can only 'rework' his utterances in rather minimal ways (for example by 'qualifying' 'restating' and 'commenting' etc.). One would also conjecture that elaborate structuring of the unfolding utterance would be difficult to process in real time by the audience. These notions lead us back to the rather weaker claims of 'retrospective organisation'. Nonetheless I do feel that we can specify some constraints on the constituents of PERIODS even if such formulation is only in broad terms.



Fundamentally I would argue that the subsidiary discourse members outlined in Ch.III do not take PERIOD initial position. By and large they are closely related to the previous discourse and GLOSSING in particular would rarely seem to begin in HIGH KEY. Those MEMBERS which do begin PERIODS are most typically of the INFORMING or FOCUSING variety and it would seem that if there is a "head" in PERIOD structure it would be constituted by one or other of these MEMBERS. It should be noted of course that both FOCUSING and INFORMING MEMBERS can occur in the same PERIOD. Indeed some of the predictive MEMBERS noted above could be dealt with as instances of the HEADING type or FOCUS (see Ch.III p 113 ). In general there seems no obvious limit on the number of MEMBERS in a PERIOD, at least theoretically speaking.

This then is the model of discourse (albeit a rather loose one) which we propose for lecture monologue: that MEMBERS make up PERIODS which make up EPISODES. We leave it to the concluding chapter which follows to examine some of the ramifications of this model.

CHAPTER FIVE

CONCLUSION

## 1. DISCUSSION OF THE DISCOURSE MODEL

It could be said that the model of analysis proposed herein contains a number of theoretical embarrassments. The chief difficulty is that units on different layers of the discourse scale draw on differing formal criteria in their isolation. Thus MEMBERS are isolated by reference to syntax, PERIODS by reference to intonation and EPISODES by reference to the type of MEMBER that occurs at their boundaries. As a consequence of employing varying criteria in the isolation of these units, it becomes difficult to establish precisely the structural relationships that obtain between them.

There does in fact exist a crude constituency relationship between the units on different ranks: the boundaries of the highest unit, EPISODE, coincide with boundaries of all the lower scale discourse units. Nonetheless it has proved difficult to delineate the structure of units on one rank in terms of differentiated units from the rank below. This is true of the relationship between MEMBERS and PERIODS as we pointed out at the end of the last chapter: apart from claiming that PERIODS include at least one INFORMING or FOCUSsing MEMBER, it proves difficult to specify precisely what types of MEMBER in what order combine together to form the structure of a PERIOD. This initial problem becomes more pressing as we move up the discourse scale: It is not possible to specify classes of types of PERIOD which in predictable sequences form EPISODES. We cannot, for instance, make a watertight distinction between FOCUSsing PERIODS which contain only FOCUSsing MEMBERS and INFORMING PERIODS which contain only INFORMING MEMBERS. Some PERIODS quite naturally embrace the two. This would seem an important point which is worth illustrating by example: the following text contains within it a short EPISODE.

Ex. 1  
(1)

p THIS is WHY // in the MAIN // p CONcentrate  
p we SHALL on dealing with

// r what is KNOWN as SINusoidal excitations // p SINE wave //  
p SIG-

(2)  
nals // r a NOther class of AMplifier // WE  
p which shan't be // r

THIS POWER ampli-  
talking a great deal about gear // r is the so-called

(3)  
fier // o this is - the type of amplifier // initially //  
p which is es

SIGnal amplifier // CURrent //  
r a LARGE p dealing with fairly heavy

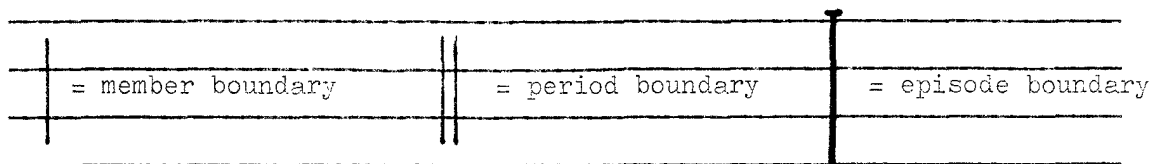
POwers  
NEAR to supply LARGE // p to a LOAD // FOR  
r + which MAY be a

// r or it LOUD speaker // p if its an  
MAY be a AUDio amplifier //

(4)

I shall be CCNcentrating MAInly

// r on AMPlifiers // . . . . .



Four MEMBERS form the text of the example. MEMBER (1) is classified as a FOCUS (RETROSPECTIVE) since it summarises the preceding discourse. In itself it forms the conclusion to a preceding EPISODE. It is also in itself a PERIOD (the final tone unit before the example is LOW KEY, proclaiming tone) since it begins in HIGH KEY and ends in LOW KEY.

MEMBER (2) is a PROSPECTIVE FOCUS (HEADING) and, ending in HIGH KEY forms the first part of a two MEMBER PERIOD.

MEMBER (3) is an INFORMING MEMBER, ends in LOW KEY, proclaiming tone before an immediately following member-initial HIGH KEY tone-unit and therefore constitutes the second half of a two member PERIOD.

MEMBER (4) takes the form of a PROSPECTIVE FOCUS (METASTATEMENT) and thus constitutes the onset of a new EPISODE.

In the example, therefore, MEMBERS (2) and (3) together form, not only a PERIOD, but also a self-contained EPISODE. In doing so, it is noticeable that the two MEMBERS are of contrasting types: one is a FOCUS, the other is an INFORM.

Accordingly the example would seem to confirm the observation that it is not possible to unambiguously specify the PERIOD types which in sequence constitute the structure of an EPISODE. All that can confidently be asserted is that EPISODES contain at least one

PERIOD (just as PERIODS must contain at least one MEMBER) and, in addition, that the MEMBERS of this PERIOD are likely to include amongst them an IMAG.

Nonetheless both of the two lower units on the discourse scale do have an internal structure, even though this structure is differently specified in each case either in terms of syntax or phonology. Thus, although the constituency relationship between the two is not altogether clear in concrete terms, each unit nonetheless has a certain 'predictiveness' about it: the likely choices as the unit unfolds are of a finite and predictable nature either in terms of syntax or phonology. Consequently, the onset and closure of such units is clearly recognisable.

Such predictiveness unfortunately does not obtain at the rank of EPISODE. The length of EPISODES, for instance, varies considerably in the data and it would seem that at this layer of structure the lecturer exercises an intermittent and possibly stylistic choice to punctuate the succession of PERIODS constituting the discourse with utterances that signal either the preceding or subsequent direction of the lecture. In this sense the setting up a discourse rank EPISODE is probably a reflection of latent patterning in the text rather than a hard and fast 'structure'. It is clear for instance that neither kind of FOCUS, the prospective or the retrospective, is obligatory to EPISODES. But if both are optional, then neither need occur. And if neither need occur, then in what sense are we dealing with a unit of structure?

Considerations such as these lend further weight to the notion that EPISODE is a mode of retrospective organisation rather than predictive structuring. It is highly unlikely in any case that such a unit could be "pre-assembled" but rather takes shape in the act of

speaking. There is of course the additional point that "the drift of our evidence is still against the likelihood of useful concept of well-formedness in discourse, above the smallest units" (see Sinclair and Coulthard, 1972, p.120). In general it would seem that the larger the discourse unit the less control the speaker has over its formation.<sup>1</sup>

Cohesion of course is one way of indicating the shape of the unfolding discourse and it is significant in this respect that cohesion - especially in lectures - is fundamentally retrospective.

One difficulty however with treating both cohesion and intonation as indicators of discourse structure (or organisation) is that this procedure presupposes a discourse structure which they can reflect. This view implies some kind of surface structure / deep structure dichotomy in the study of discourse. Indeed this has already been suggested at least implicitly by invoking the notion of underlying relations such as ADDITIVE, ADVERSATIVE etc. to explain the interpretability of MEMBERS in succession especially where there is no surface item such as 'and' or 'but' to signal this relationship. Although such terms seem adequate as a statement of inter-MEMBER relations in lecture discourse there is clearly a need for further work along the lines of Winter (1977) to establish a more complete picture applicable to other forms of discourse.

Such work might ultimately account for the constituency of

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1. As Chehov's character Siron remarks in Act IV of The seagull:

"Long ago in my young days I wanted to be a writer - and I didn't; I wanted to be a speaker - and I spoke abominably /mimicking himself/ 'and all that sort of thing, and so on, and so forth....' When I tried to sum up my argument I'd go on and on until I broke into perspiration ... I wanted to get married - and I didn't, I always wanted to live in a town - and here I am finishing my life in the country, and all that sort of thing ...."

Discourse, like life, would appear difficult to plan in advance.

PERIODS. A key problem in this study is that while the surface characteristics of PERIODS in terms of their prosodic shape seems fairly well established, no clear picture has emerged of the 'deeper' structure to which such features might relate. I would want to argue in the final analysis (as does Brazil; see Discourse Intonation, 1975, p.1.) that intonation is an important aspect of the realisation statements which relate categories of discourse to the actual utterance. And it is possible that this thesis has paid too much attention to surface features and not enough to the underlying categories: there is too much of the 'realisation' and not enough of the 'categories'. On the other hand it can be argued with some justification that only those categories should be posited which close attention to the formal features of the surface of the text can sustain. I suspect in fact that to specify constituency relationship more precisely might be to misrepresent the data.

Despite the theoretical short-comings of the discourse model proposed herein, it nonetheless seems to possess a flexibility and abstractness lacking in more refined hierarchical models. R. Straker - Cook's (1975) study was cited in the opening Chapter and has provided an invaluable starting point for the development of this study. It helped point the way to many features noted herein and indeed some of his terms have been retained (e.g. EPISODE). But such a well worked out hierarchy of units structured in constituency relationships tends to be somewhat rigid in its application to the data. It tends to work like a rather ruthless grid which - superimposed on a text - tends to conform it to its own requirements rather than reflect the extreme flexibility and dynamic qualities of an unfolding speech



event.<sup>1</sup> It is the ad hoc and dynamic process whereby monologue discourse both reflects back on itself and digresses from its ultimate direction that this research attempts to capture.

## (2) SOME PEDAGOGIC IMPLICATIONS.

(a) In the area of English for Special Purposes this research provides evidence of the cues used by lecturers to structure, partition and pattern the discourse.<sup>2</sup> A key component here of course is the work on intonation. The notion of PERIOD (and also EPISODE) can be treated crudely as devices used by the lecturer to segment the information or content of the lecture. Not only therefore do they provide an analytic framework for isolating passages in the preparation of listening-comprehension materials, but they also by implication provide an inventory of cues sensitivity to which helps the hearer in his perception of the ongoing structuring of the lecture. Recognition of PERIOD onset and termination in terms of pitch level contrasts should be a fairly easy thing for non-native speakers of English to acquire sensitivity about in the language laboratory. And this may be done not by 'teaching intonation' but inductively by presenting the learner with segmented or punctuated transcripts and with the attendant audio recording. This research also provides a crude inventory of cues for distinguishing informationally dense passages from less crucial segments. It can provide cues for ranking

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1. Mountford (1975) makes a rather similar point when he remarks that, "a model of analysis constructed with the precision of a grammatical model may be the wrong sort of model to account for the dynamic and extempore character of discourse" (p.129)

2. The difficulties experienced by students attending lectures given in the medium of English where this is not their first language can be summed up in words used by one of them: "we understand the English but can't follow the lecture". See Straker-Cook, 1975.

'degrees of relevance' of the discourse - another problematic area for the second language learner - in terms of main and subsidiary members.

(b) In the area of lecturing considered as a skill in itself it is more difficult to make concrete proposals. There is no consensus for instance on what makes a 'good lecture' possible because the purposes of lectures are so variously defined (see 16.1). The most wide ranging study of the lecture in all its aspects (Bligh, 1972) concludes that the only purpose for which lectures are as effective as other methods is in the transmission of information. As Bligh notes of course, "since the other methods are equally effective, this conclusion does not necessarily justify the frequent heavy reliance on the lecture method in tertiary education" (Bligh, 1972, p.31). However, if we take the transference of information to be the fundamental purpose of lectures in tertiary education then one mode of establishing what makes a good lecture would be comparison of different lecturing styles with the student notes to which they give rise. The analytic framework given above would help in distinguishing differences between various lectures of the monologue type.

One area in particular would be worth close attention and that is the relative effectiveness of different kinds of focussing activity. One would hypothesise that the more marked are the boundaries of EPISODES the more obvious should be the overall course of lecture. Pedagogic advice certainly concentrates on this kind of feature. Many strategies however are available for accomplishing this kind of 'directional marking' and at present we lack the evidence to assess their effectiveness and suitability in different contexts. While there is much advice about how to organise a lecture in terms of

its content we know little about how this organisation is constrained in terms of the medium. It is difficult to see how clear recommendations can be made about lecturing technique without some reference to what actually happens in practice, to which end this thesis may be seen as a preliminary, ground-clearing operation.

### (3) MONOLOGUE AND DISCOURSE ANALYSIS.

Study of spoken monologue can provide an intriguing interface between the study of written text and the developing work on multi-party discourse. Despite the fact that (for the most part) there is only one speaker in lectures, the mode of analysis proposed in the preceding chapters emphasises that it nonetheless remains a partially interactive medium. Because the listener cannot provide clear feedback indicating comprehension (or misunderstanding) the lecturer constantly resorts to the plane of subsidiary discourse in the form of glosses or asides in an attempt to keep his meaning clear: he reports, qualifies and comments on the thread of the lecture. In doing so, he is responding partly to overt cues from the audience and partly to an internalised image of the audience's characteristics and abilities. One pressing problem for him in this respect is the volatile nature of the image. Not only does his perception of the audience - either in 'real' terms 'out there' or in terms of an internalised 'other' - change constantly but so does his sense of his own relationship with it. In Chapter II we pointed out the shifting field of reference for items such as YOU or WE. There is also evidence from videorecordings undertaken in the preparation of this study that a lecturer wishing to engage more interactively with the audience adopts positions relatively closer to them than he adopts for straight formal lecturing. The kind of work

undertaken by the lecturer in subsidiary discourse in glossing or commenting on the main discourse reflects the lecturer's moment by moment assessment of the felicity of his utterances with respect to either his internalised image or the 'real' audience 'out there'.

The shape of monologue discourse, therefore, reflects its relationship with other more clearly interactive modes of talk. Indeed the scale of discourse units proposed herein bears some similarity with those proposed for other types of speech event such as the classroom lesson or the doctor patient interview. Although there is no simple correspondence it is clear that MEMBER overlaps with categories such as AOT, while PERIOD overlaps with categories such as MOVE and/or ACTION, and EPISODE bears comparison with such units as SEQUENCE or PARADIGM.

So far there has not been much success in capturing or rendering the interactive dimension of the written text. It was asserted in Towards an Analysis of Discourse (Sinclair and Coulthard, 1975) that "sentence stops are best considered as supposed points of interaction in writing" (p.123). To date, however, research tends to isolate larger scale patterning without reference to its roles in interaction (see, for example Harris, 1952; or Cutwinski, 1976) or depicts the text as interacting with itself rather than with the reader (Jones, 1974; Leachford, 1975). A notable exception here is the work of Winter 1977 who posits a closed set vocabulary which plays an instrumental role in the questions that display the relationship between one 'sentence' and another. His work provides both a vigorous and powerful interactive explanation of the intertextuality of sentences in sequence. My only reservation would be concerning the rules involved in this, viz. for as the study of discourse develops, the category of sentence becomes even more difficult to handle

systematically than it was heretofore.

One way of covering further in this problematic area would be to use intonation in reading aloud as a guide to the procedures adopted by readers in cognering and interpreting written texts. As far as I know little work has been published along such lines (although see Brazil, 1972; and following Brazil, Lees & Urquhart 1976) and this would seem a fruitful area of enquiry especially since it takes one beyond the written text itself to the dialectical interplay between the text and the reader. Such research might usefully complement Winter's work on clause relations and simultaneously draw on the approach to intonation outlined in Ch. IV above. In so doing, it would provide another element in the picture (to which hopefully this thesis itself contributes) of how language, whether written or spoken both constitutes, and is moulded by interaction.

## APPENDIX ONE: THE TRANSCRIPTS

This appendix contains transcripts of two first year university introductory science lectures and one second year introductory science lecture.

The transcripts have not been consciously 'tidied up' to any great extent. Performance errors - such as false starts, for instance - have been retained. The intention has been to render as accurately as possible every word or sound uttered by the lecturer.

## Notations:

(1) In rare cases where words or phrases have not been clearly intelligible they have been enclosed in round brackets.

(2) Short pauses of around one second in duration are denoted by a full stop. Longer pauses are denoted by a number enclosed in round brackets giving its approximate duration timed in seconds.

(3) Student responses, where they occur, are prefaced by S and enclosed within square brackets.

(4) For the sake of readability, syntactically independent units are separated one from another by use of a slash or stroke thus /.

(5) Also for the sake of readability, those parenthetical statements which are embedded within syntactically independent units are enclosed within square brackets.

LECTURE ONE

MATHEMATICAL PHYSICS FOR FIRST YEAR  
ELECTRICAL ENGINEERING STUDENTS

/Right /so let's turn to mathematics for the next forty-five minutes  
 (3) /last time I talked to you er about . this suffix notation (7 sec  
 pause while writing on board) which allows us to . handle arrays of  
 numbers (2)  $a_{ij}$  thing like (6) things like this  $s_{ijk}$  . arrays of numbers  
 and write down equations which apply to . elements in arrays of numbers  
 in a very compact and economic economical form /(2) today I want to  
 extend that and to introduce . another notation to you (2) which has  
 some advantages and some disadvantages . called the matrix notation  
 /(3) this is more specific (1) /but its . a suffix notation . is much  
 more flexible (5) more flexible and general (6) /the matrix notation 10  
 is more specific /and its also . more compact (4) as we shall now see  
 (3) /er . those were examples (1) /I'll now get down to the examples  
 in more detail . a . as to how the two notations er . relate to one  
 another . /remember if we take . er . an array which we will call  $x_i$   
 that's subscript  $i$  this is shorthand for the set of numbers  $x_1$ ,  
 $x_2$ ,  $x_3$ , up to  $x_n$  . ordered set that is it matters what order  
 you write them in ./one or four five seven is not the same as one  
 seven . five four (5) /but there is no implication of a particular  
 way of writing this . /now we may . choose to write this in the matrix  
 notation as a vector  $x$  ./ and I shall choose to underline vectors 20  
 which are one dimensional . arrays of numbers . to indicate that they  
 are so (2) /when you get more familiar with the matrix notation you may  
 drop the underlining because you will know that they are matrices (7)  
 /and there are two standard ways of writing in . er . an array . in  
 the matrix notation like that which is called the column matrix  $\begin{bmatrix} \text{you} \\ \text{put the elements . in a column} \end{bmatrix}$  . /and there is also you can write a  
 row matrix in which you . write the elements one after the other in  
 a row /it may seem very trivial just telling you how to write the  
 things down /but er . the matrix notation is concerned with the geometr-  
 ical layout of the numbers on the page or the blackboard (4) /now . for 30  
 simplicity I shall call this form . the transpose form /the row form  
 I will call the transposed form . /so I'll always write that as  $x^t$   
 underlined (4) /I'll say more about transposing in a moment (5) /right  
 (3) /you don't need these two different layouts in the suffix notation  
 . / $x_i$  subscript  $i$  is shorthand for the . ordered set of numbers /you  
 don't have to say whether you ordered them . lying down or standing  
 up /I mean its er (2) you'll see . that this flexibility of this notation  
 doesn't require such precise definition . /right now let's look at



er . a two dimensional array -  $a_{ij}$  . /that is it has two . suffixes .  
 /now . we shall . sometimes I will talk sloppily about the number of  
 suffixes as the dimension of the array . /the proper word (3) is (2)  
 rank (2)/the rank (3) of . an array (3) is the number . of suffices  
 (2) /I should actually be more more precise . free suffices . (2)  
 /two suffices are the same remember we have special rules operating .  
 /so this is ar an array of rank two . /I have to say that that that even  
 this definition . doesn't er . remove all confusion because . the .  
 the word rank is used in mathematics for for other things (1) /but  
 that's . our definition of it in this context . /so  $a_{ij}$  is . similarly 10  
 . shorthand for set of numbers [we wrote it down last time I won't  
write them all down] . a one two a one one a one two up to a one n and  
 then a two er one a two two up to a two n and so on up to a n n .  
 /now the matrix notation . way of writing that down . er . [and I  
 will write . square ma two dimensional matrices . with two underlines  
 . for the moment . just to remind you ] is to write [I think its  
 fairly obvious you . (3) at least it it's . one of two obvious  
 choices] . you write . as the top row of the matrix a one one a one  
 two a one three up to a one n . second row a two one . up to a two n .  
 and so on till the nth row is a n one . a n two . up to a n n . /there 20  
 are n squared elements . /and er . that's the way they go . /now .  
 the only thing that is tricky . is to know . whether you you . you .  
 write them by rows or by columns . /had you chose chosen to written  
 write them by columns in the same way . you would have got . a  
 different layout (3) /the rule is . that the first suffix . label  
 the row . (7) is the row label and the second suffix is the column  
 label (4) /that's a completely arbitrary choice . /but it's one that's  
 as well to make . (6) /so if we put these down in words we can say .  
 in the matrix notation . the . ith element . of the matrix  $x$  once  
 underlined . is  $x_i$  . and . the element . [that's the the one dimensional 30  
definition] . the two dimensional definition . is the element in  
 the ith row (2) and jth column (4) is  $a_{ij}$  (7) /now we will before  
 we're through we will need to meet three dimensional three suffix .  
 arrays . /and there is no . convention for writing them down in matrix  
 notation /its part of its limitation (15) . /now I can put in some  
 extra little definitions . which er are necessary in order . to . er  
 work freely with matrices . /we define the transpose matrix (7)  $a^T$

(2) twice underlined (4) the  $ij$ th element of the transposed matrix . is  $a_{ji}$  (2) /now what that means . is the element in the  $i$ th row . and  $j$ th column of the transposed matrix is obtained by reversing the role of row and column labels (4) /I'll . that is the second choice that I . I mentioned before /if we had written down columns . a one one a one two and so on . a one  $n$  going downwards a two one a two two and so on we would have generated the transpose matrix (2) /its called transpose actually because if you draw that diagonal line through the matrix . and just flip the thing over you arrive at the transpose matrix /every element is swapped . with the one on the opposite side of the diagonal (2) /so that swaps with that an  $a_{n1}$  /that's the operation of transposition (2) /it's not clear now why you'll need it but I'm mentioning it now for the sake of completeness (4) /I shall mention two other definitions . because er . we will need them . later . er . although they . won't mean much to you now . /there's the complex conjugate matrix (4) which we will call a star  $\underline{a^*}$  (2) /and it's very simple . /it's  $ij$ th element is simply . the complex conjugate . of  $a_{ij}$  /in other words you just take every element in the matrix and take its complex conjugate . /now all but one of you have met complex numbers already . so that that will mean . something to you . /finally . what's called the hermitian conjugate . which is the combination of these two operations . /its usually called a dagger  $\underline{a^T}$  . / and its  $ij$ th element  $\underline{[that's the matrix]}$  . is . the complex conjugate of a transpose (4) /and that means that it is just  $a_{ji}$  . complex conjugate (4) /and that all sounds rather complicated /forget about those last two definitions but note them down /we'll . ss . want them when we come back to them (10) /right (10) /now . problem sheet one question one /has it got to the back / . erm asks you to work in the suffix notation . and write a lot of things out . in full . because remember all these equations in the suffix notation er are shorthand . for sets of equations . /sometimes the set only contains one equation but normally it will contain more . /the number of equations corresponding to the number of . free . suffices (5) /right . er (3) /I will simply work one example of that sort /but I'll remind you first of the summation convention (2) which we had last time which says . that . when a suffix is repeated  $\underline{[now let me put it very briefly]}$  that the repeated .  $\underline{[remember repeated suffices we call dummy suffices]}$  (3)

10

20

30

/repeated suffices are summed over (7) from one to n /always from every  
 suffix runs from one or n (3) /remember that the repetition had to be  
 within a single term (3) /right . so . I will write down perhaps the  
 most er the important equation of this sort [which isn't actually  
explicitly there] so that I can do it as an example which is the equation  
 $a_{ij} x_j$  equals  $b_i$  (3) /okay (1) /now how many free suffices are there  
 in that equation then I'm going to ask you how many dummy suffices  
 there are in each term (2) /what is the what are the free suffices (8)  
[someone answers] louder louder what? [S: is there any? there isn't  
any] well . /what are the suffices? /let's go slowly what . [S: i  
 and j] i and j i and j . /so we have to decide er which are the free  
 ones /maybe we'll decide which are the dummy ones /those are the ones  
 to the left of the free ones /now . which . how many terms are there  
 in that equation [S: three?] three . /how many people think there are  
 three /how many people have has anyone an alternative suggestion to  
 three [S: two] two . /how many people think there are two (counts  
 hands) yes (4) /how many people think there are three (5) /the definition  
 of a term was something separated by a plus or an equal sign /and er  
 so that there are indeed two terms . /now . a repeated er a dummy  
 suffix is one that is repeated in a single term . /so . what dummy  
 suffices are there in that term [S: j] /j . /j is dummy . /and there-  
 fore i is free . what about this term /what dummy suffices are there  
 (2) [∅] silence . /there aren't any . right . so . the rule is  
 therefore that the equation exists for every value of the free suffices .  
 /let us write it down first of all with n equals two . /that is i and  
 j take on the values one and two . /so . what do we do about j .  
 /it's a dummy suffix /what do we do about it (3) [S: sum it] sum  
 it . /yes . /we sum over it (2) /but . we have to write this equation  
 down for all the values of i so let's label the equation by i where i  
 equals one and i equals two (2) right . now I'd like you to write down  
 now . this equation . for i equals one . and summing over j /write  
 it down (8) /write the left hand side down write your right hand down  
 and put an equals (30) /how many people have finished come on / (20)  
 right . /my turn (2) /so . on the right hand side is the easiest  
 thing so let's do that first . /i equals one /so we put b one . /the  
 left hand side has i equals one so we put a one there for i /and j  
 occurs both as the second suffix on a . and as the only suffix on x .  
 and j has to be summed over /so . first of all we'll write down the

term  $j$  equals one . /and then we'll write down the term  $j$  equals two .  
 /and then we'll add them (4) /so the equation is a one one  $\times$  one plus  
 a one two  $\times$  two equals  $b$  one (4) /any mystery (2) /right . now write  
 down the same equation . for  $i$  equals two (2) /for this you get thirty  
 seconds (20) /right . so . all we do then is change the label  $i$  where-  
 ever it occurs /it's the first suffix on  $a$  and the suffix on  $b$  /so  
 it's a two one  $\times$  one plus a two two  $\times$  two equals  $b$  two (4) /right .  
 and that's the answer . /that is short for that . /not much profit  
 you might say for all this complicated  $i$ 's and  $j$ 's business /I would  
 have rather written that down . /OK . well I'll not ask you to increase 10  
 $n$  to seventy-five . /but we'll increase  $n$  to three just to see the  
 thing begin to build up . /now what is the effect of increasing  $n$  to  
 three . /there are two effects . /er I mean I don't mean detailed  
 effects it depends on the look of the system of equations . /what will  
 happen . /somebody [ ] /what /you'll get another term  
 /another term /another term /from where [ ] /in which  
 equation /in both /in both equations /you'll get another term in both  
 equations in which it will be a one three  $\times$  three plus a two three an  
 a two three  $\times$  three there because the sum over  $j$  will run over an extra  
 term / $\Sigma$ : and we'll have another equation /and we'll have another 20  
 equation corresponding to  $i$  equals three (writes on the board) and so  
 on ' $n$  /if  $n$  was seventy-five there would be seventy-five equations .  
 with seventy terms on the left hand side of each /okay . /no mystery .  
 /right . /now . let me say er . to come back to matrix notation you  
 can now do question one although you'll doubtless have to think a  
 little bit . /okay . /and question one is simply to give you practice  
 in that /you see when you look at that for the first time and I ask  
 you to write it down . then . the universal response is is to nervous  
 about putting pen to paper /well I hope you overcome that . /it's  
 the rejection factor I was telling you about . /well it's op it 30  
 operates on this . /it shouldn't operate so strongly now . /right .  
 now let me tell you what the matrix notation . for . er . this equation  
 is . /it's simply . it's actually the same set of equations in matrix  
 notation ( )  $\underline{a} \times$  equals  $b$  (5) /now . you couldn't know that because  
 I haven't defined yet the operations of addition and multiplication  
 for matrices (7) /they are defined . in question four . /and I want  
 you . looking at the book . to yourselves work through this basic .  
 er . setting up of a whole new notation in mathematics (4) /I told you

the relation between the mat the definition of a matrix . and the corresponding suffix (notation) . /now . I will first briefly go through these definitions but not . slowly enough so you'll understand them . /I intend that you should learn these yourself . /but first of all er . I want . to be sure . that . you all . have met the . three words . commutative commutative associative and distributive . /how many people . have heard those words and know what they mean . /so there are some of you who haven't . /okay . /well . as always in mathematics there's a grandiose term for a simple idea (6) /when you set up a number and we'll be coming back to deal with fundamental 10 things like that in a bit later . er after we've dealt with this specific example which will be useful to illustrate the general points . a number system consists of a set of elements /let's think of integers /they're the elements one two three four five six seven so on the negatives ones and zero (2) and two operations . We shall be interested in such number systems called fields usually<sup>7</sup> (5) and these two operations (2) /there are the elements which I will call a b c and so on . or occasionally I will call them  $a_i$  but I'll try and avoid that for confusion because . er . it will generate confusion . /there are elements a b c /and we have two operations (2) which we call 20 adding . and multiplying . plus and dot . because for ordinary numbers we identify them with ordinary addition and multiplication . /you can define number systems in all sorts of ways . which I will . as I say talk about later . /now . /so (8) /we will look for three properties . commutation . add . multiply . /we'll make a little table . /commutation is the statement under addition that a plus b equals b plus a (2) /commutation under multiplication is the statement that a times b equals b times a . /that's the definition of commutation . /it is a commutative number system if that if those two relations hold . /commutative under addition commutative under multiplication (2) /it is associative 30 (3) if (2) /now I'm using brackets to indicate the order in which things are done /remember you always evaluate the inside of brackets before . anything else . /so if I write a plus b in brackets plus c . I mean you add a plus b first . then you add c onto it . /that . it is associative . if that is equal a . plus b plus c . that is you add b and c together first and then add on a (2) /and if it is not commutative it is important to keep the ordering of the factors the same . /notice a b and c occur in the same order on both sides . /similarly for

multiplication (2)  $a \cdot b$  all times  $c$  is equal to the  $a$  times  $b$  times  $c$  (5) /so . I'll go back to adjectives commu: commutative, associative, and distributive (3) /these are definitions . three lines and lots of arrows . /a distributive is a link between the two number systems /it is the statement of the extraction of brackets /that is  $a$  into  $a$  multiplied into  $b$  plus  $c$  equals  $a$  times  $b$  plus  $a$  times  $c$  /that is it doesn't matter whether you do the multiplication first or the addition first . /now all the all the number systems that . er . you know (2) er except matrices . satisfy all these properties /you have to find out I'll give you clue that matrices do 10  
 not satisfy all of them for those of you who haven't met this (2) er . /but er . they satisfy most of them (3) /these are words that (2) even if you had a traditional maths course you really should have heard of . by now . although they are not I admit on the prerequisite sheet (2) /is is everybody clear about that . /so this is the statements that one plus two . plus five which is three plus five . is equal to one plus two plus five . which is one plus seven 'n they're both equal to eight /there it's a set of very obvious statements /it's the statement to two times three equals three times two . /right . now I promise to mention briefly the definitions of the definitions of er . 20  
 multiplication . of of of of matrices . /but I think I'm pressed for time and there's one more thing I want to introduce you to in this rather nectic lecture . /er so I will leave you to look that up in a book (1) /as I say my highest ambition er . is that all our students by the time they leave us can at least learn from a book (6) /right (2) /I will say I am I er we will be coming back to go over this of course next week . /if you can discover it for yourself it will be that much more memorable to you . /right . I'm now going to go right away from this rather abstract approach (4) and talk about the solution of sets of linear equations . which is what problem sheet nought is 30  
 about . /now . I don't think you'll have any trouble . er solving problem sheet nought (5) in a (2) completely ad hoc way . without using systematic methods /but what I want to teach you now er is a systematic method (7) of solving (3) sets . of . simultaneous linear equations (15) /okay . /some of you already will know a systematic method . many of you I regret to say will er know a systematic method based on ratios of determinants . /how many people have been taught . to solve sets of equations by working out determinants and dividing

one by the other (3) yes . /well . that's the normal way to teach it .  
 /and er . it is fine . er for . the sort of size of matrix that you  
 have been asked to invert . /but . er . I should explain why it's not  
 so good in general . /to work out a determinant . an  $n$  by  $n$  deter-  
 minant . involves  $n$  factorial . er multiplications and additions (4)  
 /er . the method I'm going to teach you . involves  $n$  cubed over two .  
 er (or er . ) maybe over three . hardly matters . er multiplications  
 and additions . /now . when  $n$  is three (2) you will see . that this is  
 still larger than that (1) /but when  $n$  gets to be . six . let alone  
 when  $n$  gets to be a hundred .  $n$  factorial becomes a very expensive 10  
 thing indeed . /now in fact of course nobody nowadays would ever  
 dream of solving . a hundred by a hundred matrix erm . by hand /for  
 one thing it would take them several lifetimes to do so erm . /but  
 er . it is . you you may want to deal with intermediate size matrices .  
 /and . it is also important to know . how computers work when they  
 invert matrices . because they will invert to a hundred by a hundred  
 matrix for you . in considerably less than a lifetime (1) something  
 like a second /and er (1) er (1) they . they of course work in the most  
 economical way which is this (1) way which uses a method called pivotal  
 condensation (2) which is a nice old nineteenth century . term (3) 20  
 also sometimes called Gaussian elimination . /almost all . results in  
 mathematics are named after Gauss . who invented them all . (3)  
 /perhaps you can't call every theorem Gauss's theorem /some other  
 people got in . on the act (2) /he was a clever guy (2) /right . so  
 I'm now going to do an example . illustrating how we . use this method  
 /you will see the the general method I think better by an illustration .  
 than by er (4) /and that will finish the hour . / $x$  plus  $y$  plus  $z$  equals  
 two (5) /two  $x$  . plus three  $y$  . plus four  $z$  . equals six . /now . I  
 would like to ask you to stop writing (2) because I think you will  
 follow this better if you don't . /and I promise to give you a chance . 30  
 to er . recover from that . very daring thing to do er (1) afterwards  
 (2) /I think you may miss the point if you /sorry five  $x$  . plus . three  
 $y$  . plus  $z$  equals six (1) /I hope I've cooked this so the numbers come  
 out reasonably nicely . /but please don't look don't look at it and say  
 Oh we must just try a few things . because the real world is not like  
 that . /okay . /now . it will make my argument simpler for me if you  
 allow me . to write the equations by bringing the numbers over onto the  
 left hand side . /that is . subtracting the right hand side from each

from the left hand side of each equation . /so we get minus two . equals  
 nought . minus six equals nought . minus six equals nought ./okay  
 /this is just to make the argument simpler /there's it doesn't make any  
 difference . /but we now have a set of things . which are all zero .  
 /okay . /and the essential point of the method is that I can add any  
 multiple of zero . to er something else . without changing it (2)  
 /d'you . is that clear /shall I say it again /if I have some quantity  
 (2) like this . even if this were not zero if I have some quantity here  
 and I add . something which is zero to it . it isn't changed . /and  
 if I add three point seven two seven times that times zero to it it is 10  
 still not changed . /is that quite clear to everybody that this is the  
 thing we have to hang onto and the rest is just . playing games (2)  
 /right . now of course one doesn't know what x y and z are at this stage  
 and so one . as we were all told we couldn't add sheep to goats or  
 apples to oranges so we must not add x's to y's at this stage /we  
 keep things therefore tidily in columns . /okay . /now . what I want  
 to do however . er the is is to get to the situation where we have  
 one of the equations which is easy to solve . /and that situation will  
 arise if the equation is in (2) a form such that there are only zeros  
 below the diagonal . or above . /but we'll make that choice . because 20  
 the bottom equation is then the equation z minus equals nought .  
 which you and I can both solve without working too hard . /okay . /so  
 the first stage of this method is to get rid of all the elements below  
 the diagonal by adding multiples of zero . /and the second stage I  
 might as well tell you now . is to work backwards because having solved  
 z minus six equals nought . sorry no the second stage is then to get  
 rid of all the elements above the diagonal . /okay /and then we have the  
 equa the top the bottom equation is z minus six something equals  
 nought . /the second equation is y minus something equals nought . /and  
 the first equation is x minus something equals nought . /okay . /now 30  
 I don't expect you to . have more at this point . than the idea of  
 adding multiples of zero . to to equations . which doesn't change their  
 their their content /it doesn't change them at all . /and to aim . to  
 eliminate all but one variable from the equations . /and the method we  
 proceed is the one I've described to you . /of course you're used to  
 the idea of eliminating variables but one tends to do it in a rather  
 sort of ad hoc way by substituting . when one started on this game .  
 /and then came these determinants which one . never really quite



understood why they worked . /but we'll understand even that by the end  
 of this course /but er . so now we come back to this method . /now .  
 /so . we will leave the top equation unaltered because remember our  
 first objective is to get rid of these elements . (min) x plus y  
 plus z . minus two equals nought . /okay . /now . what multiple of the  
 top equation do I add to the second equation in order to get rid of  
 two x /S: minus three /minus three /S: no . minus two /minus two .  
 /have a vote /who thinks minus two . /who thinks minus three /right .  
 /so let's add minus two times this . to that . minus two x plus two  
 x is indeed nought . er . minus two y [ ] er gives y one y . 10  
 minus two z is plus two z . I need a bit more space . minus minus  
 two is plus four minus two equals nought . /okay . /x . plus y . plus  
 two z . plus z . minus two equals nought . /okay . /now for the third  
 equation what multiple of this do we have to add /minus five /minus  
 five . /okay . /so then we get nought . minus five plus three is minus  
 two y . min . minus five z plus z is minus four z . plus ten minus six  
 is plus four . /you have to check me because it's easy to make mistakes  
 /so now notice we got rid of those two . /the next step we want to is  
 to get rid of him /now how do we get rid of him [ ] /we can't  
 use this equation 'cos that will put x's back [ ] /you use the 20  
 second equation . /and what multiple of the second equation do we add  
 to this /S: plus two /plus two . /so . er you'll forgive me if I don't .  
 write everything out every time because (2) we've still some way to go .  
 /but I won't start rubbing out . because that really will worry you  
 when you're not writing things down . /er so we then have x plus y  
 plus z /actually you will allow me to do one thing though /you will  
 allow me not to write down all these . plus signs which . cloud the  
 issue so much . /in fact in a moment you're going to allow me . just  
 to label the columns x y z /in one you can write one . one . one . and  
 minus two . /okay . /and then for the second equation one two . and 30  
 minus two (4) /and for the third equation we're going to add plus two  
 to that . so we got nought nought we get another nought . /that gives  
 us plus four z minus four z . which is (pause) nough no z's /laughter  
 and er /laughter (pause) and er /laughter /right . /this is a lesson  
 I wasn't meaning to teach you at this point /laughter /I better  
 generate myself another equation . /let me explain what I have done .  
 /it will help you in your later understanding (10) /I have . produced  
 three equations here which are not really three equations . /the third

one . is a combination of the other two . /when you do this procedure  
 you learn that fa that fact . /in fact the the determinant of the  
 equations for those of you who have met them . the determinant of the  
 left hand side should have vanished . /and its because of that that I  
 got into trouble . /in geometrical terms each of these equations  
 represents a plane in three dimensions . /and two planes intersect in  
 a line . /and . of course a third plane the third equation will cut  
 the line in a point and that's what I'm trying to do . /what I have  
 done . is got a third plane that goes right through the whole line .  
 /just to link to geometry /right . /well I'm now going to assume . that 10  
 the bottom equation because I think I remember what the numbers I put  
 in first turned out to be of that form . /that will enable me to proceed  
 down this along this way . /er . in other words that we had got it in  
 that form (2) /the examples you have to work with . I hope will not  
 have this this problem . /so . that's our diagonalised matrix . /now  
 let us go backwards and eliminate . the two . er sorry it's in a  
 triangular form now /now let us eliminate the two . which we can do  
 by adding minus twice this equation . if we leave this one alone one  
 minus one . /and minus twice that equation to that one . /and we get  
 one . nought . er nought . /that's alright . /and now we want to . get . 20  
 get rid of these two things . which we will do . by adding minus one  
 times this equation to that one and then minus one times that equation .  
 /okay . /and the final result will be to replace the top equation . by  
 one . er nought /er that is zero so it makes no effect . /here we have  
 minus one . instead of minus one . /and the top equation is one nought  
 nought minus one /and the second one is one . nought . nought .  
 /and the third one is one . minus one . /now . we have to put back the  
 labels /and remember that this is the statement . that one times z  
 minus one times one equals nought /that is its the equation z equals one .  
 /this is the equation one times y . plus nought equals nought /that 30  
 is y equals nought /and this is the equation one times x . minus one .  
 equals nought . /so that the answer is . that x . y . z . equals one  
 nought one . /and you'll be able to check that that is indeed the  
 solution of these equations . /erm you might like to write down . er  
 work backwards and find the equation that would have generated us .  
 a one and a one there /it clearly had an extra z . and an extra (2)  
 minus one there . /okay . well apologies for that confusion /now you  
 see we have a systematic method . which . will work . to . er . with

any number of equations . /suppose we had had four equations in four unknowns here . we would have had to have four successive steps or three successive steps of elimination because the top equation is always there . you leave it alone . erm eliminate first all three . and then two . and then one . /okay . /so the number of steps of elimination is  $n$  minus if we have  $n$  equations  $n$  minus one . plus  $n$  minus two . plus and so on . down to one . an arithmetic progression which you know how to sum and gives us roughly  $\frac{n^2}{2}$  . er (3) eliminations /in this case we had two plus one . /if there were three we'd have three plus two plus one and so on (2) /er /right . /in 10 fact what one gets precisely is  $\frac{n(n-1)}{2}$  . /you add that arithmetic progression . /now . er . in each of them . there is a reducing number of operations to do . /in the first one you have  $n$  plus one operations to do . /one of them is going to give you a zero so you have effectively  $n$  . /that's er when you go through the first time /when you go through the next time . /or maybe I should do this carefully . /so the first time through there are  $n$  minus one rows . /and . you have  $n$  terms in the row . /the second time through there are  $n$  minus two rows . /and there are  $n$  minus one terms in the row . and so on . until the end . you get er . two times 20 one . /and . if you sum that series up you find that it gives you the order of  $n^3$  operations . /and that's er where where I got my number  $n^3$  through . /I'll show you that the determinant involves  $n$  factorial . another time . /right . /well question three asks you to do that for a three by three . /er question two asks you to do it for two by two no sorry for three by three and four by four respectively . /this is just arithmetic /and you will find it quite easy /but you may get confused /and it is of course important to check your answers at the end . /but is everybody clear about the procedures . and about the basis of it . /you are always adding multiples of one equation . which 30 is zero to other equations . /and you choose it so you produce zeros . if you've got some array like this (7) to produce zeros first down there . then down there . then down there . and so on . till you get it down to triangular form /and then you . produce zeros up here . up here . and so on . so that in the end it's just a diagonal set of equations of the form  $x_1$  equals something  $x_2$  equals something  $x_3$  equals something and so on / (3) right have a go at that . /that . you are er to have a go at over the weekend and you

will receive (further) problem session on that stuff on . Tues on  
 er . Tuesday at twelve . /are there any questions /we've covered a  
 hectic amount . /er the reasons are partly organisational because it  
 will be some time before I give you anything more to digest /all  
 these things are of course well covered in the book . except the suffix  
 notations which is not well done in Boas / (6) /okay . /right so  
 now . er has anybody got a problem with the preliminary survey /I  
 don't mean can are there any of you who can't do all of it /I'm sure  
 there are /but is there anybody er not have the copy with them or  
 anything of that sort . /if so can you make sure that you hand it in 10  
 next time /☐ ☐ /you never had a copy . /I have a few here but er  
 only . I've only brought two /who never had a copy ☐ would you m ☐  
 /no . /I wouldn't mind having them on a piece of paper at all /I  
 put them on er in fact I would expect you to have to work on a piece  
 of paper /the reason why I gave you a form to hand them you know asked  
 you to put them in on the question paper is just that it's much easier  
 for me to erm to handle them in that form /er I'm not interested  
 really in a detailed understanding of your level of knowledge but just  
 whether you have got the basic ideas ( ) /when do we have to  
 hand them in ☐ /I'd like them in this afternoon /I'd like you to hand 20  
 them to John by four o'clock ☐ /I'd rather you didn't /I don't  
 really want you to make a big deal of this /er I I would rather you  
 handed them in er at the end of this afternoon /er and get on to the  
 problem sheets of the course itself /er ☐ /aha /everybody should  
 have a problem sheet nought and a problem sheet one /and on at the  
 the Greek alphabet is repeated on the back of problem sheet nought  
 /so you can safely give it back to me on the back of the preliminary  
 survey where my secretary put it by mistake /problem sheet one /☐ ☐  
 /sure /☐ ☐ /on the on the preliminary survey /no I don't /can you  
 look those of you who have mislaid your copies of the preliminary 30  
 survey could I ask you to look over your neighbours and write it on  
 a sheet of paper /but try and put it in roughly the same place so that  
 I can look at the same little squares to see the answers (2) because  
 it's er a significant amount of work going through these things and I  
 don't like to juggle it by having a varying format (4) /okay/

L E C T U R E   T W O

AMPLIFIERS AND CIRCUIT DESIGN  
FOR FIRST YEAR  
ELECTRICAL ENGINEERING STUDENTS

Now I've got . something like twelve hours of lectures . with you .  
to introduce you to the subject of . electronics . /now the book that  
I recommend . is now costing I'm afraid something over three pounds /it  
was just three pounds when I bought mine . /er it's this one . 'Electr-  
onics . for Engineers' by Spreadsbury /it's a very readable book . /it  
is I think the best one . for this course that . is . currently avail-  
able . /it contains a little more than we shall manage to cover this  
year . /but that means of course that it will be useful to you next  
year . /but it does contain . in a very readable form . all the material  
which . I shall be covering this year . this phase . /there is another 10  
one which you might like to have a look at . /you might even like to  
buy it . /it isn't all that much more expensive . /it was three pounds  
thirty I'm not sure what the current price is . /it's called 'B J Ts,  
F E Ts and Microcircuits' . /it's a McGraw-Hill publication , /the  
initials stand for Bipolar Junction Transistors . F E Ts for Field  
Effect Transistors . /that is not such a readable book /it's packed full  
of information . /it's a very good book in its way . /but it isn't so  
easy to read . /but you might like its style better than Amhed and  
Spreadsbury . /I don't recommend that you buy that one . unless you  
feel you need its rather mathematical style . /that's the one I 20  
recommend you buy . /there are a lot of other books on electronics .  
none of which I am going to recommend . /um which books you do buy .  
I think it will have to be largely up to you depending on . what style  
you like what level you feel you need /there are books at very  
elementary levels which are very useful . if you aren't . able to  
understand . the other two books that I've recommended . /um there are  
books which will talk about . how transistors work . how field-effect  
transistors work . how you make transistors . /this isn't essential  
reading for this year . /it may help you in your understanding of how  
to design circuits with them though if you do know a little bit about 30  
them . /this book tells you how they're made in relatively simple terms  
but if you want to go into more detail there are other books . /I  
would suggest that before actually buying any . other than perhaps  
that top book there . that you look at it carefully perhaps borrow it  
out of the . departmental library or the main library . and see whether  
it really does help you (8) /I'm going talk about electronic circuits  
(15) /now (2) /I've put this slide up to show you where what I'm going  
to . talk about . comes in . /electronic circuits is the application

of devices . to . together with . resistors inductors and capacitors  
to produce . circuits that perform . certain specified functions .  
/now there are a vast number of these functions which one can . imagine  
. /electronic circuits can by and large be broken down into two main  
classifications . analog circuits . and digital circuits (2) /digital  
circuits we shan't be talking about this year at all . /that belongs  
to phase two . /we shall be talking about . essentially . analog cir-  
cuits . /now there are a large number of analog circuits /there are  
amplifiers . /there are frequency changers . voltage regulators . er  
mixers, feedback circuits, ramp generators . and thousands of different . 10  
operations which analog circuits can perform . /but we shall be dealing  
. primarily with one class of analog circuit /it's perhaps the most  
important one . /and if you've got a grasp of that particular aspect .  
of analog circuit design you can rapidly expand . into the others as  
well . /so we shall be concentrating on amplifiers . analog amplifiers  
(4) now amplifiers of course can perform . a number of different  
functions . /they can amplify . what are essentially steady voltages  
or currents . sometimes and rather . unfortunately called O C amplifiers  
direct current amplifiers . /what it means is its amplifying a steady  
voltage . /or . we might amplify . a small . but time-varying voltage . 20  
/it needn't necessarily be a periodic wave form . /it might be . something  
that does this . /this might be the output of some measuring . trans-  
ducer . measuring . the velocity of the wind outside . /it's not a  
periodic er wave form at all /but you want to know you want to amplify  
this very small signal and use it in some way . /so . the amplifier  
may be called upon to amplify time-varying signals . /they may be  
small . or they may be very large signals . /the difference between  
small signal amplification and large signal amplification . I hope  
will become clear to you during the course of the er lectures (2)  
/the wave form may in fact be periodic . /the simplest one of course is 30  
the sine wave (4) /it could of course be a square wave (3) or a . rec-  
tangular sort of wave or a triangular wave . or any other periodic wave  
form . /there's no restriction on the sort of input wave forms that we can  
apply . /the ones we shall be talking about most however are in fact .  
amplifiers . of sinusoidal signals /these are the . signals we have  
to deal with most . /and in fact since you can take . a periodic wave  
form such as this or this or this and break it down . into its  
component sinusoids . /in other words a square wave is made up of . a

sine wave of frequency  $f_1$  . /if you add to that . a smaller signal only a third the amplitude . of three  $f_1$  . and then five  $f_1$  and seven  $f_1$  you actually build up . this . square wave . /and this is true /any periodic wave form can be broken down into a number of component sine waves of different frequencies . /this means that if we know what the response of our amplifier is to . sine waves . we've really described . its action . to not only sine waves but all the other periodic wave forms as well . /this is why we shall in the main concentrate on dealing with . what is known as sinusoidal excitations sine wave . signals . /another class of amplifier which we shan't be 10 talking a great deal about this year is the so-called power amplifier . /this is . the type of amplifier which is essentially a large signal amplifier . dealing with fairly heavy current . meant to supply large powers to a load which may be a motor . or it may be a . loudspeaker if it's an audiamp (3) /I shall be concentrating mainly on amplifiers for . amplifying . sinusoidal signals A C signals alternating current . /this is a misnomer . /to say it's an alternating current voltage an A C voltage as so many people do of course is a bit of a nonsense . /um . we all do it so I'm afraid that I'm going to have to use this rather loose terminology /I hope you'll know what I mean /I 20 mean a periodically time-varying signal . which is probably sinusoidal (3) /so we shall be dealing with small signal and large signal A C amplifiers . and amplifiers . of . steady voltages . D.C amplifiers (4) /now an amplifier . consists of . some electronic device plus a handful of other components . /and a typical transistor amplifier . might look like this (15) /now that is the theoretical circuit diagram of . a transistor amplifier (6) /it's got one active device namely a transistor . and a number of resistors and one or two capacitors (3) /now you as designers will have to . know . what is the function of each of those components . er . and be able to assign values to each of these compon- 30 ents (2) /but as far as the basic process of amplifying a small signal connected onto the input here . is concerned there are really only two . elements for doing any real amplification the transistor itself . and this resistor here . /as far as the signals . the alternating signals are concerned only those two components are doing useful work . /the others are there to carry out a process known as biasing (2) /in other words just to get the device . into a working state . /without these other components this will not act as an amplifier . /so we have



to take the basic device . and operate it in such a way to make it work in the way that we want it to (4) /and these components are . associated . with getting the device initially into the state that we want (2) /now we shall look during the lectures at the number of different devices (2) the . valve . mainly for interest's sake /they're not used very often these days (2) but they're relatively simple to understand /we shall be talking a bit about valves /we shall be talking about transistors . both . bipolar junction transistors (4) bipolar transistors (6) /these are the common or garden transistors . these are the ones that were first produced . in the fifties ./er we shall 10 also look at another type of transistor called the field effect transistor (14) and something called an M O S transistor which is a metal oxide semiconductor transistor (10) M O S transistor . /and of course we shall also look at the properties of some . integrated circuits . . . which are . quite complex structures . comprising a number of transistors . and resistors . and sometimes capacitors . all on a single . piece of silicon which measures only about one millimetre square . /it's a very . complex . circuit (7) /well let's ask ourselves what is it an amplifier's intended to do (8) /to save ourselves the . trouble of writing down . the complete theoretical circuit each time we refer to amplifier . we 20 very often use . a symbol which represents an amplifier (10) /and that is the symbol of an amplifier . /we have an input terminal and we have an output terminal /to that output terminal . we would connect the external load (3) /this symbol here . is . the . earthing . terminal often referred to as ground or earth . /and we would apply . a signal let us in this case say it is . a sinusoidally varying signal a sine wave from a laboratory oscillator . connected to its input /in other words the input signals . the voltages are injected with respect to earth potential /this is zero volts (2) /and so we are injecting an alternating signal here and we would expect to get a larger version of 30 this (1) here which is being fed to our load resistance which we usually call R L (2) /now that defines the general amplifier (1) /we can talk about the input voltage  $V_{in}$  . here . and the output voltage . here  $V_{out}$  . measured with respect to earth . /so that's the voltage that appears across the load resistance (1) /and we can define . immediately two properties of this amplifier . /if we take the ratio of the output voltage to the input voltage this tells us . how many times bigger the output is . compared with the input . /this we call the voltage gain .

/so the voltage gain of the amplifier given the symbol  $A_V$  is  $V_{out}$  over  $V_{in}$  . (3) /we could equally well measure the current flowing into the input terminal of this amplifier and measure the current flowing out of the output terminal . /in other words the input current  $I_{in}$  supplied from the source . the output current  $I_{out}$  supplied from the amplifier which flows through the load . /and if we take the ratio of the output current to the input current . that is also . a gain . if it's an amplifier . /and we call that the current gain  $A_i$  (4) /output current over input current (3) /and so . our general amplifier will have two properties . a voltage gain and a current gain (1) /now . there are 10 many amplifiers available today . which don't just have one input /they have two inputs . /most modern integrated circuit amplifiers have two inputs . /once again we would connect the load (1)  $R_L$  to the output terminal of the amplifier /but we have two inputs (3) /and we can connect a voltage  $V_{in}$  one to one terminal . and a voltage  $V_{in}$  two to the other terminal . /now . these are . what is known as differential inputs . /in other words if in fact we make  $V_{in}$  two equal to zero . /I'll put a negative sign there . and a positive sign there . 7 and we apply . plus three volts there . /and this say has a gain of two . /what we would get out here . is a voltage of minus . six . /in other words . it 20 inverts the sign of the input voltage /so if it's plus three . it comes out as a minus . six . because we're multiplying the magnitude of the voltage . by the gain of the amplifier /so the gain is two /two times three is six . /but it's a minus six because it inverts . the polarity (3) /if instead of putting the voltage onto there I put plus three onto here . I get plus six out . /this terminal does not invert the polarity (4) /therefore I have a choice . /I can . insert . the voltage either on that terminal . or on that terminal /and depending on which one I use it will either . invert or not invert . the polarity of the input voltage (3) /I could equally well of course . feed a voltage . to (4) 30 both terminals simultaneously . /I could put plus . two on that one and plus . three on that one . and what I get then . is an output voltage . which is twice . the difference between these two (2) /in other words this . path gives me plus six . this path gives me minus . four . /and so the answer is plus two . /and what it's done you see is to multiply by the gain of the amplifier the difference between the voltage of these two terminals . /this is why we call it a differential amplifier . /it measures the difference . between . the voltage on the two . input

terminals (2) /if of course I was to make that a minus . in the first  
 place and have a negative voltage going in . I would have three minus  
 minus two which would give you five . multiplied by two so the actual  
 voltage would be ten (1) /but it always takes the difference between  
 the voltages . on its two input terminals . /and so that . is another  
 form of amplifier which we shall be . coming across quite frequently  
 the differential amplifier . /its voltage gain . is the output voltage .  
 divided by the difference between the two input voltages (8) /er slide  
 it up a bit more (2) cover that bit up for the moment (4) /now these .  
 input quantities . these input voltages as I said can be . steady 10  
 voltages . as . in our example here . plus three minus two /these are  
 steady voltages not changing with time . /these are our so-called D C  
 inputs . the steady input voltage . /equally well they could be some  
 form of time-varying signal either a periodically time-varying signal  
 (1) /they don't have to be periodic (2) /but we . in the main shall be  
 talking about sinusoidal . input signals . so-called A C signals . /so  
 these input quantities the input voltage and the input currents can  
 either be steady voltages or currents or . sinusoidal voltages and  
 currents for our purpose (1) /now if we in fact measure the product of  
 the input voltage and the input current . that gives us the input 20  
 power .  $\sqrt{\text{volts times amps is watts . input power .}}$  supplied in this case  
 . from . the source (5) /let's take a hypothetical amplifier /we connect  
 it to a given load (4) and we drive it from a laboratory oscillator .  
 /we measure I-in and V-in . and we measure V-out and I-out (6) /the  
 power supplied by the oscillator is . V-in I-in . /and the power dis-  
 sipated in the load . is of course the product of V-out I-out . so  
 (5) /now if it's a good amplifier . it will have both voltage gain and  
 current gain . /so V-out will be much larger than V-in . and I-out will  
 be much larger than I-in . /therefore the power dissipated in the load .  
 is much larger than the power . supplied to the input terminal (4) 30  
 /in a typical example it may be as much as er ten thousand times greater  
 . /question is where does this power . come from (1) /there is obviously  
 an increase in power available to us (1) at the output . compared with  
 the power available to us at the input /after all that's what an amplifier's  
 about /that's why we bother with them . because they are . increasing  
 the power available to us n /now where does that power come from (2)  
 /anyone know? //S: inaudible /it comes from a thing magically known as  
 the power supply . /er . it's a box of tricks somewhere . which supplies

usually . direct . power (3) /we call it the power supply unit (20)  
 /now the power supply unit may be a battery (2) /as such it's a source  
 of power (1) /it's a direct . current source . /and . it's connected  
 to the amplifier . /and the actual flow of power to the load . is in  
 this direction . /it's fed from the power supply unit through the ampli-  
 fier . to the load . /now this load may in fact be simply as I've  
 shown here a physical resistance . /and all that it's doing then is  
 warming it up . /or it may be a loudspeaker if it's an audiampifier  
 /it may be a motor . if we're trying to . produce movement . /or .  
 it may represent the input . of the of the next stage /we may want to 10  
 cascade a number of amplifiers one behind the other /so this . load  
 resistance for this stage is in fact . the load imposed by the next  
 stage (3) /but whatever the load is . the power . fed to that load is  
 derived essentially from . either a battery or a mains-operated power  
 supply unit . /now . when I drew this simple theoretical circuit here  
 . you notice I didn't actually draw in the power supply /I just indicated  
 that it was present . by saying that you need to feed this from a  
 supply . which will give you plus twelve . volts . /now this is the way  
 we normally operate /we don't bother to draw in the power supply unit  
 normally /we just specify . that a certain potential is necessary /but 20  
 remember . that all the power . fed to the load . /we would connect a  
 load here7 (1) all the power fed to that load . is derived from that  
 power supply (4) /virtually none of that output power . is supplied by  
 the input (3) /maybe . one hundreth of one per cent is in the example  
 I chose . /but . virtually . none of the output power comes from the  
 input source (2) /if the . amplifier has a power gain of ten thousand  
 then as I . in the example we looked at earlier . then in fact the con-  
 trol source . the input source only supplies one hundreth of one per  
 cent of the total power required at the output . /the rest of it comes  
 from the power supply (4) /therefore . this . input signal is merely 30  
 controlling . the performance of this amplifier . /and this amplifier  
 really . is controlling the flow of power from the power supply unit  
 to the s to the load . /it's rather like a valve . /it's like a tap if  
 you like if you like to consider the . analogy . with a domestic water  
 system . /when you turn the tap on . you're letting . water . flow .  
 from some . reservoir which is equivalent to the power supply unit . to  
 the load whatever it is . the garden sprinkler or whatever (2) /your  
 hand . isn't supplying any of the water . /it is merely supplying . the

information to control the amount of water that goes through . /and that really is what an amplifier is . /it is some . rather elaborate electronic valve . that is . allowing that in response to the . controlling input signal allows power to flow from the power supply unit to the load (2) /now as soon as you've said that you can see that there are a number of . ways in which an amplifier can go wrong or not give . exactly what you want of it (10) /to be able to . well let me just draw a single example . /one form of amplifier could be as follows (5) /there's the power supply unit . giving the voltage of plus V (2) /and there is the load resistance . /there's earth (1) R one R two . /and 10 we can say that all inside that . this . blue box (3) represents our amplifier . /and let us say that this is a variable resistance . which is connected to the outside world in some way . /it may be motor-driven . /or maybe you turn it with you hand /but it's a variable resistance . /now . the voltage across the load (2) is what /would anyone like to say (10) /well first of all you would want these . the voltage that appears across the load also appears across this resistance 'cause the two are in parallel . /so I'd have to combine these two in parallel and form an equivalent resistance . /so this is equivalent to . R one . and a new equivalent resistance . across which the voltage we want appears . 20 of R two . in parallel with R L . which is  $R_2 R_L \text{ over } R_2 \text{ plus } R_L$  (2) /and . if we want the voltage if we've got a voltage V plus applied there . and we want the potential there . we can say that . V .  $R_L$  which appears now across the parallel combination of those two .  $V R_L$  . is equal to  $R_2 R_L \text{ over } R_2 \text{ plus } R_L$  . times . V . divided by  $R_1 \text{ plus } R_2 R_L \text{ over } R_2 \text{ plus } R_L$  . /so that's an expression for . the output voltage . /it is a certain fraction of the input voltage . /and the actual fraction depends of course upon the actual . value of this resistance /and as we vary it . so we shall vary this resistance and we shall vary the output voltage . because essentially . we shall 30 be varying that quantity . that quantity . that quantity and that quantity /so the output voltage will vary (3) /but you can quickly see from . this . relationship . that the actual . as I vary  $R_2$  .  $V R_L$  will . vary in some rather strange manner . /it isn't directly related to  $R_2$  . /I can't say that  $V R_L$  is . directly proportional to  $R_2$  can I . /it isn't . because  $R_2$  appears there there there and there . /so even if I can get . a linear . variation . with time . of  $R_2$  . the output voltage won't . be linear . /now what do I mean by linear /let

us say that . I am going to operate . with the passage of time I'm going to rotate that control so that . there is zero resistance and there is maximum resistance and this is the variation of  $R_2$  . /let us say we have . a linear variation with time (2) /if you in fact look at this expression you'll find that the output voltage . I don't know what it is /I've not bothered to work it out/ but we'll say it does something that looks more like this (3) because in fact  $R_2$  appears in various places in this expression . /the variation of voltage isn't . in accordance with the input quantity /the input quantity is the linear variation of  $R_2$  with time . /the output voltage does not vary linearly with 10 time . /now this is one of the problems you see as soon as you go to a practical situation . /you . don't necessarily . have . a linear relationship between the input and the output . /and in designing an amplifier you strive to get this linear relationship . /it can never be . completely linear . /but you try to get it as linear in operation as you can . /the straight definition of linearity is that the . output should be proportional to the input . exactly at all times . /now . if in fact . the output . voltage differs from the input control (2) then we say we've introduced distortion . /so if we have . an amplifier exhibiting non-linearity it will obviously distort . the signal . /the output signal . 20 will not be quite the same as the input signal /it will be a distorted version of the input signal . /and in amplifier design . we want to keep the . amount of distortion to an absolute minimum (5) /but . this is . essentially the problem . /it's in using our . various devices . in such a way that we minimise this distortion (3) /um . another thing that we want . is to say that the amplifier has . a low . intermodulation (1) performance (7) /say for instance we feed . our amplifier from two signal sources simultaneously one oscillator . an oscillator there and and oscillator there . with respect to earth (2) /now we can choose the amplitude of the signals we feed in from these two oscillators and we 30 can also choose the frequency . /thus we can feed this into the amplifier with a frequency  $f_1$  and this with a frequency  $f_2$  /and what we should . get at the output is an amplified version of this signal . added to . that signal (2) /so the output should . comprise two signals . one of frequency  $f_1$  and  $f_2$  /now if in fact . there is non-linearity . in the amplifier . and the output is not exactly proportional to the input . then what we might find is we get  $f_1$  amplified  $f_2$  . amplified . but we also might get  $f_2$  minus  $f_1$   $f_2$  plus  $f_1$  /in

other words we've generated some new frequencies in the amplifier (2) /this is a process known as intermodulation (2) /it's a damn nuisance (1) /er . if you . those of you that know something about Hi-Fi . when you look through the (2) specification of a power amplifier you may see . that it says intermodulation . /it tells you . what is the position how much . of the unwanted signals are generated by the presence of . the wanted signals . /you can imagine if you've got a violin (2) playing . and . we'll take an extreme example and a bass drum simultaneously . er you wouldn't like to get a combination of the two coming out in addition to the two required tones /intermodulation sounds very nasty indeed . /it makes the sound instead of mellow or sweet . or . in the case of the violin penetrating it sounds makes it sound rough . /there are signals present which weren't present in the output which weren't present in the input . /that's known as intermodulation distortion and should be kept . as low . as . possible (1) /another thing which you've probably all heard . if you take your turn er take an ordinary record player don't bother to put the er pick up down on the record but just turn the volume control up you'll probably hear a hiss (2) /well that's an unwanted signal that isn't present at the input because nothing's going into the input of the amplifier . but something's coming out of the output . which is unpleasant . /it's called noise . electrical noise (2) /so . one would want to keep the noise output in the absence of input signal to a minimum . /now of course all these requirements are difficult to achieve . /and the designer strives pretty hard to maximise his linearity reduce his distortion keep intermodulation . down . and to keep the noise down (20) /right . well that is the requirements . /and I think I've . shown you one or two of the problems and the difficulties that arise when you try to make real amplifiers . /wer (2) now then . /how do we actually set about analysing . an electronic network an electronic circuit . /and how do we go about the design (2) /well . there are . two types . of . network (2) /there's a . so-called . passive network (5) represented by a box say . with two terminals . /and it may have resistors in it . and the odd capacitor . but nothing else /it has resistors inductors or capacitors in it . /there are no sources there no batteries no . transistors or anything . /that is known as a passive network . /it contains purely . resistance . inductance . capacitance . /that's a passive network . /it may have two terminals .

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/or in fact it may have four terminals . shown here . /I shouldn't  
 bother to copy these down . /this is really Professor Allansons's  
 subject er circuit theory /I'm just trying to differentiate between  
 the two basic types of . circuit . /there's the passive circuit two  
 terminal four terminal with an input and an output . /and there are  
 some called active . networks (6) /and these are the ones that we're  
 interested in . /an active network is one that contains a source /this  
 may be a source of voltage . or a source of current (4) a battery a source  
 of voltage . or . an A C voltage source (3) /this is the symbol of a D  
 C voltage source a direct voltage source a battery /this of an alternating10  
 voltage source . /or it may contain current sources . which has a symbol  
 like that . /this is a source of current (2) /it's a bit unfortunate  
 we don't have a different symbol to distinguish between direct current  
 and alternating current /we use the same symbol . /but . the fact that  
 it's a capital 'I' tells you that it's direct current . and the small  
 i tells you you're dealing with alternating current . /here . you do  
 have a difference in symbol . although they tend to be used this can be  
 used to represent a D C voltage source as well /there's no general  
 agreement on this . /a capital V will tell you it's a direct voltage  
 /a little v . will tell you that it's an alternating voltage . /so 20  
 capitals . denote . steady values . /little . letters denote . lower  
 case letters denote . er . alternating quantities . /now any network  
 which contains one or other of these or . combinations of these an  
 anything else resistors inductors capacitors is said to be an active  
 network (13) /now . there's one additional . type of network that can  
 be said to be an active network . and that is a circuit . containing  
 a transistor . a valve . an F E T . or multiples of each of these or  
 combinations of each of these . /now transistors in themselves aren't  
 sources . /valves aren't . /a transistor as you've all seen is a little  
 gas incapsulation with three wires . coming out of it . /it is not a 30  
 source of power (2) /from that . as far as . that is concerned it  
 looks just like a passive element /it has no . inbuilt batteries or  
 voltage sources or current sources . /but as soon as you put it into a  
 circuit . and you . do what you have to . to get the thing working .  
 /it's this process I referred to as biasing earlier on7 . then currents  
 will flow through it . voltages will appear across it . /and you can  
 vary those voltages and those currents . by . applying voltages and  
 currents . to the control terminal of the transistor . /and as far as



the outside world is concerned . it is very convenient . to represent the transistor . plus its power supply . as a source . /the power supply is really the source . /but it is very convenient from the . point of view of analysing what goes on in these circuits to say that . it's the transistor that's the source . /it makes for simpler understanding of circuits (1) /so . we also say that any . circuit containing . a biased transistor or a valve or an F E T or an integrated circuit is also . an active circuit . /that's not strictly true . but . it's very convenient . to be able to do so . /the point is . the reason we say this . is there is the amplifier containing the transistor . there's the power supply . there's the load . and there is the control . /now as far as the . load is concerned . what it sees is current being fed to it and a potential .  $V_{out}$  . being applied across it . /now as far as the load is concerned . it doesn't know whether that's coming from . a battery in here . the value of the voltage of which is changing with time . or whether it's coming from a power supply unit via the amplifier in response . to the control signal . /and as far as the load is concerned it doesn't care what . which of those two situations actually obtains . /all it is interested in doing is getting its current at the right voltage .

/therefore . this . sort of argument enables us to say . that the (1) amplifier with its transistor is an active network . /in reality the transistor on its own is a purely passive device . /it does not contain any sources . /but when we put it into circuit . it's very convenient to say it suddenly becomes an active . device . /and in fact we then build up . what is . a model of that device /we can say . well once we get it into circuit . the transistor behaves . in the following fashion . /it behaves . as . a current control current source . /I'll be explaining that term next time . /the important thing is . it enables us to simplify the analysis . of these devices . to regard them as sources in their own right . /we produce what is known as a model . of that device /it's an equivalent circuit . for the transistor . /we might use the term equivalent circuit or we might use the term a model . a mathematical model . /the actual transistor might look like that . /it stands a quarter of inch high . /its mathematical model looks like that (2) /and the fact that we can make use of these mathematical models enables us to very greatly simplify the analysis of what goes on /we don't have to consider the physics of the device /this is the important thing . /we don't have to consider . the exact way the transistor works

if we can . represent it by a simple equivalent circuit a simple model .  
 /we don't have . to bother about . how it actually works . /now this is  
 important . /there are so many different types of device . currently  
 on the market . that if you had to understand the precise operation of  
 each one of them you'd spend all you time doing that /you'd never get  
 around to actually designing any circuits . using them (1) /you'd spend  
 all you time just well learning how what is the physics of the device .  
 /by using these models . we can . short circuit this process completely  
 . /we can design /we can analyse . /all we have to know is what the  
 device does . not how it does it . /and this is important because . as 10  
 time goes by more and more . devices come onto the market /different  
 types of devices . using totally different physical principles are  
 being introduced from time to time . /and you . have got to be able  
 to design . with the devices that are likely to come along in the next  
 twenty years . or forty years . depending on however long your careers  
 last . /um . therefore . you shouldn't really be concerned at this point  
 with how does it work /you should be asking yourselves what does it do .  
 how can I simplify this into its simplest form . and what sort of model  
 can I use to represent it . /and then get on with the job of design .  
 /so it's important . to devise . these equivalent circuits . /now one 20  
 point of warning about these equivalent circuits of course is . are  
 they adequate . /you can go on make you can make equivalent circuits  
 which are very very complex . which fit all the observed facts /when  
 you devise an equivalent circuit what you're doing is producing a  
 circuit which behaves . in exactly the same way as the transistor .  
 obeys . er behaves . experimentally . /all these equivalent circuits are  
 experimentally determined . /at least they have a basis in experiment .  
 /you can simplify the sophisticated circuit for a lot of operations (2)  
 /um we shall see . as we go through this . that . the full equivalent  
 circuit of a transistor is very complex but we shall use simplified 30  
 versions of this . because they're adequate for our purpose and they're  
 much easier to handle . /and of course you can go on simplifying and  
 simplifying until you reduce it to absurd lengths . /so . the point  
 that I'd like to make . is that you must suit . the complexity of the  
 mathematical model that you use . to the application that you have in  
 mind (4) /well . it's one thing to say well there's my transistor /I  
 can represent it as follows . in a circuit /and I can analyse that  
 circuit /Professor Allanson will show me how to analyse the circuit

/once I've put it got the equivalent circuit . he will show me how to  
 analyse what goes on /and I will know all about what goes on in that  
 circuit . /now that's part of the story . but of course the transistor  
 or the valve is . the physical entity . /and we also have to make sure  
 that . it can pass the current . /Mr.Mellitt pointed this problem out  
 to you the other day /it's no good expecting a hundred amps to pass  
 through a tiny transistor /it'll go pop . /you have to select an  
 appropriately sized transistor . /can it withstand the voltage . /can  
 it dissipate the power . 'cause it's got current flowing through it .  
 voltage across it . /that means that power is being dissipated in it 10  
 in the form of heat . /can it get rid of that heat before it burns  
 out . /so you've got to be concerned with what are known as ratings the  
 voltage current and power rating of the transistor (1) /you should  
 concern yourselves as engineers with what does it cost . /is it readily  
 available /it's no good saying that's a marvellous transistor /it only  
 cost four pee /but you can't buy it 'cause it's out of stock . /is  
 there a cheaper solution /in other words can you use a cheaper device  
 /don't overspecify . /don't use a five pound transistor where a four  
 pee one will do . simply because you happen to like the colour of it  
 (.) /is it safe . /is it reliable . /is it electrically safe . /are 20  
 its terminals connected in such a way that they won't cause damage to  
 itself or its neighbouring components . /is it reliable . /this is  
 often related to the design of the circuit and not the actual cost of  
 the component . /a component is only reliable . if you obey . if you  
 operate it within these maximum ratings . /if you exceed any one of  
 these . it'll have a short life . /often how big it is is important .  
 /what power requirements are needed (2) /and of course the mechanical  
 packaging may be important /if it's a military component it'll have to  
 be proofed against all sorts of nasty things vibration . shock . humidity  
 /it'll have to operate from minus forty degrees theta plus eighty 30  
 degrees C . /they're very . strict on the operating conditions .  
 /industrial components there are slightly less strict conditions on  
 these . /these all dictate the form of packaging you use /and that also  
 you will have to take account of . /so (1) I'll leave you with the  
 thought that not only have to got the to use the appropriate model for  
 the application /get your design out /you've also got to select your  
 components so that they'll do the job that you want them to . /will do

it reliably and as cheaply as possible (4) /right we'll stop there  
um (2) /some copies of the syllabus here for those that didn't get one  
on Friday /I won't actually hand these out /I didn't get as far as I'd  
thought I might /I'll hand this out next time.

L E C T U R E T H R E E

INTRODUCTORY BOTANY  
(Supplementary Subject)

FOR SECOND YEAR STUDENTS OF  
BIOLOGICAL SCIENCES

### A.33.

Right /well now you'll remember at the end of the last lecture . we were . looking into the differences . between the root and the stem . as seen in transverse section (1) /and the first point that we noticed was . that um . in the root we have . er a narrow steele . strengthening material in the centre of the root . /in the stem . much more superficial . /and remember that this was related to the forces . the main forces acting upon er these organs (2) /er (1) in the same way if the steele . is er narrow then the cortex in the root . will be wide . /in the stem if the steele is wide . then the cortex will be narrow . /and related to these er forces which act remember that in the stem you also 10 have very often er this um layer of um collendima (1) cells thickened at the corners . /and these are just under the epidermis /so once again strengthening material . um . near the surface of the organ (1) /now another if you think of these sections which you've seen in the practical class . um you'll remember . another point of difference . /in the . root . the xylem and the phloem occur on different radii /remember this sort of business (3) the xylem here and the phloem . in the grooves . /so that er thinking of the organ as a whole which of course will be much larger than the board . in proportion . er . the xylem main limbs as it appears in transverse section of the xylem are on a different 20 radius from the phloem (1) /in the stem . er the situation is different . because the xylem and phloem are on the same radius (1) /now if you have a stem with separate vascular bundles like this . and so on (1) [just show xylem and phloem for simplicity xylem here phloem towards the outside .] these are on the same radius (1) /er not all incidentally not all stems have this um . arrangement of separate vascular bundles . /these are always taken this type of stem is always taken as the type for the herbaceous dicotyledonous stem the young herbaceous type dicotyledonous stem um /but er . it only really represents about half (1) er of the flowering the dicotyledonous flowering plant kingdom 30 because about an equal number of plants have (1) a continuous ring of phloem and a continuous ring of xylem on the inside (1) /and er why this is never brought out . er . in er elementary courses er I don't know because this is not necessarily representative of structure as a whole /but the rule about being on the same radius still holds good . /if we have a complete ring of phloem and a complete ring of xylem then . on any radius er the er phloem and xylem are going to be on that radius (2) /in the roots certainly the protoxylem at any rate and part

of the metaxylem alternates with the phloem . /so this is another good  
 point er to bring out erm if you are asked to . compare the structure  
 of a dicotyledonous stem and a root (5) /now another . important point  
 which um . arises is the position of the protoxylem where the xylem is  
 first formed (1) the position of the protoxylem in relation to the  
 metaxylem (1) /er . in the root . the protoxylem is out here (1) /in  
 the stem the protoxylem . [this is the inside of the stem] the protoxylem  
 will be found here (2) /so in other words . in the root . the protoxylem  
 is on the outside (1) and the xylem . subsequent xylem forms inwards  
 (1) /in the stem the protoxylem on the inside and the subsequent xylem 10  
 metaxylem and so forth . is produced . outwards (3) /now there are  
 technical terms which apply to these two conditions . /when the protoxylem  
 is on the outside and subsequent xylem development is inwards . we say  
 that it is the structure is exark (7) /we find that in a root /erm in  
 the er . stem the opposite situation where development is outwards from  
 the inner protoxylem . you refer to this . as endark (9) /now I think  
 that's as much as we . need to say . er for your purposes . regarding  
 the er . structure and anatomy . of the . flowering plant /and I want  
 now to turn . to . erm speak for the rest of the erm . course . on  
 flowering plant reproduction (5) /now I would er refresh your memory 20  
 again . er about er . the sort of general structure of the plant .  
 /remember this thing with er which we had a simple diagram . showing  
 soil level . the root system down here (2) and so forth . the main stem  
 producing leaves (5) and having buds on it of two kinds . those which  
 occur . in the angles formed between the leaf stalk and the stem .  
 which we call axillary er buds . and . the terminal bud (1) /the  
 axillary buds can develop (1) er . into er lateral branches . /and  
 these lateral branches . will . reproduce the structure of the main stem  
 /that er axillary bud there develops . /it will produce its own stem with  
 leaves and axillary buds and a terminal bud (4) /growth in length of 30  
 the original stem . the original main stem . continued by the terminal  
 bud (1) /and er these er buds . in general . have the characteristic  
 of . indefinite growth /once they begin to develop they go on and on  
 (1) /course for various reasons . a particular plant according to  
 conditions . erm individual buds may remain dormant for long periods .  
 /nevertheless they . have the . capacity . for indefinite growth (2)  
 /now the um (1) flowers of the plant (1) [which of course are what  
we're going to talk about in relation to flowering plant reproduction]

(1) these are . as it were . modifications . developed from modifications of buds (4) /flower buds may replace (1) some of the axillary buds . /or a flower bud may replace the terminal bud . /but . the point about it . the point of difference is . that the flower buds . are of limited growth (1) /once the bud opens and the flower appears and matures then . that is the end of the growth . of that particular . er part of the plant . /if the terminal bud develops into a flower . then . the growth in length of the main stem has come to an end . /and if any further . vegetative that is non-reproductive growth er is involved at a later stage it must be . by means of the development of laterals (2) er 10 axillary buds (2) /er the converse holds good that if the . axillary buds develop as flowers then growth of the plant . er is er maintained . by er . activity of the terminal bud (2) /now of course er plants as you may know . erm flowering plants are of er two main kinds . /there are those which complete their life-cycle in a . single year a single growing season . and these are what we call annuals (3) /and there are those which are . which go on from year to year . producing flowers each year . and increasing in er size of plant . and these are what we call perennials (1) perennial plants (4) /now er let's er think of er (1) 20 what er . the flower is like and first of all . we'll deal with the sort of main er characteristics (1) /one can look upon the various parts (1) of the flower . as modifications . of . the leaves which would be present in an ordinary vegetative bud (3) /and er what I'm going to do is er put up a sort of general diagram first of all . /and then we'll er describe the various parts of the flower and then later on . go into er go into . er . details of er variations . which we find in the different parts . and end up with a consideration of the actual reproductive process (2) /now in er . a flower which has er . open and fully developed bud flower bud is open . and the thing has developed to maturity (2) we find that the flower is built . up upon the basis of . er this structure 30 here which I've shown as erm . er as a sort of dilating . axis . rounded at the tip . /and here again . there are . many variations . /and er we'll come onto those er later on /we'll just take this . as a sort of basic type to begin with . /now this . is the . end of the . axis of the stem /this is a modification of the stem . a modification of the . stem of the bud originally (2) equivalent to the short stem which you saw from example in the Brussels sprout . a stumpy thing with all the leave on it . /well now this er represents the same . thing . /the apex up here



meristematic and um this um . axis which however here is somewhat swollen rather than tapered . as in a vegetative bud such as the Brussels sprout (1) now /if we/ we find that borne . on this um . short stem (1) which doesn't grow any more . /fixed length once it's reached er maturity .7 er we have various categories of organs . which can be looked upon . as um . modified leaves modified in connection . with reproduction (1) /erm . there are er . varying views actually on this matter but er we won't go into that /the generally accepted view is that the . parts of the flower . are to be looked upon as modified leaves (1) /now first of all if you work up towards the apex of this structure /this structure 10 is called the . receptacle (8) strictly the floral . the floral receptacle (3) /now on this as we work the way up . sides of the receptacle . we come to . a ring . of structures . which er . can vary in shape /if we look down from above . er they might look something like this (1) /if this was a cross-section of the receptacle you might have things like this (3) and so on (2) /and these structures are referred to as the sepals of the plant (8) /now (1) the number of sepals . er depends upon the particular . flower that you're dealing with . not necessarily the species . but er the small group to which that flower belongs (4) /they also vary . in the . degree to which they are joined together . /some- 20 times you find that the sepals are . quite separate . and you can take er . a pair of forceps and pluck them off one by one (2) /sometimes you find that they are joined together . and the degree of join also can vary (1) /they may be joined and most frequently are . just in the basal region or perhaps for up to half their length . /and then the . distal parts are separate . /now there's a general term . which we er use . in connection with the sepals (2) /the sepals are collectively referred to as the calyx of the flower (5) calyx (1) /so . if we er carry on with this um . thing here . /it's er over the stem this um over this thing (4) got the receptacle there/ (4) /and I'm going to show 30 the um . calyx . like this (3) in a very diagrammatic way (4) /now normally the calyx . um is er . /part of the calyx that is the sepals/ are green in colour and they look rather like scale leaves (3) /if we move up slightly up the receptacle . we come to another . group of er organs which normally /often have to use this word normally/ . are larger . than the sepals (1) /sometimes they're of the same shape . /and er there's really little point in putting up er another drawing equivalent to the calyx drawing . showing the form . of the er erm of the next type

of organ . /er this sort of shape would be um . quite typical for one of them (1) /but they're usually much larger than the um (2) sepals (3) /and we might show them like that . on the diagram . /now these are what we call the petals . of the flower (4) the petals (2) /and er once again there is a collective term . to apply . to these . /the collective term for the petals is the corolla (15) /so here's the um (2) calyx (2) /here's the corolla (6) /now while sometimes the . corolla . er can be er green like the calyx (2) it more frequently is of a different colour (1) maybe white or indeed of any colour . /in fact the characteristic feature of the corolla . is bright colour er which er gives the 10 . appearance and character of the flower to the casual glance (3) /erm occasionally . some flowers . some types of flower . er the er corolla can be missing . altogether . /there may be no corolla (3) /sometimes in those circumstances . the sepals . function . as a corolla . and are not small and green . but become large and coloured . looking like petals (3) /sometimes again . both . categories of organ . may be present . and both may look the same (1) /in other words the sepals may be large and coloured . and indistinguishable . visually . from . the petals (1) /er because of um (2) to take account of these um cases . there is er an overall general term . applied to calyx and corolla . 20 /these two lots of organs together are referred to as the perianth . of the flower (3) /so a perianth may be distinguished quite easily into sepals and petals . /or . er . the two may not be capable of being distinguished er except on the basis of position . /the lower ones . are . could probably . be called the calyx (5) /now er I mentioned that in most cases the corolla . is large and coloured sometimes assisted . or replaced by the sepals (1) /and this . is in connection . er with the reproductive process (1) because a great number . of flowers . er depend . er . upon er insects . flying insects . erm for . the process which we call pollination which we'll come on to . later on (4) /what 30 pollen is and how it works and so forth we'll deal with . er in a subsequent lecture (2) /but er . conveyance of pollen from one flower to another . is an essential part . of the reproductive process . /and this . very often . is brought about through the agency of flying insects such as er bees butterflies and so forth (3) /and er the . bright colour of the er perianth particularly of the corolla (2) is looked upon as one of the features . serving to attract (2) er suitable insects to the flower (5) /well now er this is not the (1) end of the er (1) general

structure of the flower /indeed we have not yet . got . to the essential parts of the flower that is those parts without which . reproduction would not be possible (3) /these are as it were the er trimmings of the flower er serving a function (1) the sepals when they're green . normally . er acting um to protect the developing the rest of the developing flower in the bud stage (2) the corolla serving to attract er insets (3) /erm but er these er organs are not themselves directly involved in reproduction (1) /I would draw your attention to the fact that not all flowers by any means depend upon insects for the process of pollination . /quite a large number<sup>9</sup> the grasses for example . er depend upon the agency 10 of wind (1) to carry . the pollen (2) /and it's not surprising therefore . that in such plants (1) erm . the corolla . is usually . rather small . and insignificant . /there is no need . as it were for . to have a brightly coloured corolla (4) /now (1) /again . moving up . the receptacle . we come to another group of organs which . look very different . from the perianth parts (3) /and once again I'm just er showing a sort of diagrammatic vertical section . of the flower (3) /these er structures . are characterised by having (2) er relatively long . erm . stalks (1) which are more or less um . circular in cross section . /and then on the top . they have (5) a head . which er (1) is somewhat elliptical . 20 /it varies actually in shape . /er it is not . circular in cross section that is in that direction . /it tends to be lobed . /and that's why I've drawn a line down there (3) /we'll um when we come to the er practical er this afternoon and er on Monday . we'll be looking . at er . er an example of a flower maybe actually seeing . these um organs . /but er . these things then have a stalk . which varies in length and thick-ness according to the particular flower (1) and . a head . which is affixed on the top stalk in various ways . various points again according to the plant (1) /and er (1) these er organs are referred to as stamens (6) /and these can er be looked upon as the male parts of the 30 flower (9) /now the stalk of each stamen . is referred to as the filament (8) /and the head . of each stamen . is referred to as the anther (5) /so . anther and filament bracket together as stamen (5) /now just as we had . um collective terms . for .sepals . and petals (2) we also have one to cover . the stamens (2) /and er this term is the androecium (5) /it's an oe dipthong (5) /the androecium (1) that's the collective term for all the stamens in the flower (8) /well now we're getting rather near the apex . of um the receptacle (3) /and er we come now to

the final . erm . component . the last of these er floral components .  
 /and er the form (2) forms which er these organs take . erm is er highly  
 variable . /we may . for example . find (2) as we move up . the sides  
 of the final dome . of the receptacle . a number of structures which  
 (1) are somewhat Indian club shaped (10) /it might look something like  
 that (5) /er (1) the actual shape in a particular flower varies quite  
 a lot between different flowers . /erm sometimes er . the er neck part  
 here is very short (2) /in some (1) flowers . quite a number of them .  
 instead of getting er a number of these structures quite separate . at  
 the top . you may get . er them partially joined together . so that 10  
 I'm going to put up um (1) another bit of receptacle . apex . here (3)  
 /in some cases we find something like this (3) /in other words we have  
 one sort of . globular structure at the base there and then a number  
 of . separate stalks projections out of the top like that . /now that's  
 rather suggestive . that um (1) this type of structure has been derived  
 from this (1) in evolution by the fusing together of the basal parts  
 leaving the tops . free (6) /er another stage . in this process . you  
 could end up with what looked like a single (2) Indian club shaped  
 structure on the top (3) er which looks like one of these (2) but has  
 in fact been formed by the fu the total fusing together . of a number 20  
 . of separate structures (1) /you might say well now how do we know  
 that (2) /well we can find out very often . more often than not by  
 cutting a transverse section . of this er bulbous space . /and if we see  
 in transverse section . something like that . with partitions . three  
 compartments . that suggests that that . structure has resulted from  
 the fusing together in evolution . of three . separate . structures (3)  
 /so um the er situation at the top of the receptacle . varies quite a  
 lot /it's difficult to say er to illustrate a typical . erm example .  
 /that's why I've mentioned . these er three forms . /now these er  
 structures are referred to as the carpels (10) CARPELS . not to be 30  
 confused with bones (4) /so in this example here we have three .  
 separate carpels . /in these examples we have . fused carpels . in this  
 case partially fused . in this case totally fused (4) /there is er a  
 collective term again . to . describe the carpels . /and this term is  
 the gynaecium (3) /once again there's a dipthong but this time it's  
 ae dipthong (3) /and the gynaecium represents the female part of the  
 flower (16) /now I just want to refer mention one or two terms which  
 er further terms which er . are worth . erm . knowing in connection with

er . the general basis of floral structure . /going back to er the  
 sepals you remember that these could be wholly separate or they could  
 be fused together . to different extents (2) /if they are separate then  
 we refer to the calyx as being polysepalous (8) polysepalous (6) /if  
 they are fused together (3) to any extent (1) er then we refer to them  
 as being gamosepalous (8) /and er a synonym . of gamosepalous is  
 synpetalous er synsepalous (15) but gamosepalous is the normal one (2)  
 /er likewise in connection with the um . corolla (8) we have er poly-  
 petalous (4) and normally . synpetalous (2) /gamopetalous is also used  
 but the common usage in this case . is synpetalous (4) to cover . 10  
 separate petals . and joined petals . respectively (4) /now while we're  
 on the subject . again . of . the petals (1) um . this er drawing um  
 diagram which I've put up here . you'll notice . is a symmetrical (1)  
 diagram (2) er suggesting that all the um petals and all the sepals and  
 so forth are the same (5) when you look down from above on to the flower  
 all the petals . look the same shape and size . that the whole thing is  
 radially symmetrical (1) /but this again is not always the case . by  
 any means (2) /in quite a number of flowers (3) er the um (2) the  
 foxglove and various other ones (1) they're not . /the flowers are not 20  
 . radially symmetrical . /they're asymmetrical . /and this asymmetry .  
 is almost invariably . due . to . the petals being unequal in size and  
 even . being differing in shape (7) /if the flower as a whole (2) is  
 radially . er symmetrical . then we say that it is an actinomorphic  
 flower (9) actinomorphic . radially symmetrical (4) sepals all the sepals  
 all the petals and so forth (1) are symmetrical . in shape and size (8)  
 /er er there may be alternating differences /as you go round a ring of  
 petals you may have . large ones and smaller ones . alternating in a  
 ring . /but the overall effect is a radial symmetry (4) /if on the other  
 hand . there is a marked . asymmetry (1) then we say that the flower is 30  
 zygomorphic (11) actinomorphic . and . zygomorphic (5) /now I think we've  
 said enough er about petals . and sepals . because as I've mentioned .  
 these are not . the truly essential . organs of the flower . from the  
 point of view of reproduction . /if you can get . the pollen of the  
 flower transmitted . by some agency or other . then reproduction can  
 take place even if the flower had no calyx . and no corolla (3) /let  
 us therefore . spend some time . thinking . about . the androexium . or  
 the male part . of the flower (5) /now er . I've shown (3) er these er

again on the diagram as separate structures (1) /er it is possible it often happens . that erm there is some degree of fusion . of stamens . /but when this occurs it only relates to the filaments . /you don't get the anthers fusing together . only the filaments . /and here again . the degree of fusion can vary (2) /you may have . the filaments fused (2) down below and then the upper ends free (2) /or . you may have the filaments all fused together . so that you have . a sort of androecium tube . with the anthers . er round the top (13) /now I mentioned that er when we were talking in general terms . that the um . filament is attached to the anther in various ways (1) /um . it can be attached . 10 more or less as I've shown there at the mid-point (3) /or . in some flowers . it's attached . at er one end of er the anther so that er . here's the upper end of the filament and the anther sits . on the top of it . like that (1) /the anther is upright instead of being . more or less . horizontal (6) /the degree of um . rigidity of the connection of the filament to the anther (1) can vary . according to the plant (1) of to the flower (5) /very often . the anther is er pretty rigidly affixed attached to the top of the filament (2) /but in some . flowers . notable again the grasses (2) er the connection is er rather lax . so that . the anther can move . very freely . on the top . of the filament 20 . /now this is a feature which is found . in those flowers or very frequently found in those flowers which depend upon the wind . to convey pollen (2) /why should this be so (1) /because . the wind can blow the anther the anther can shake around . on the top of the filament . and the pollen . which the anther contains as we'll see shortly . er can be shaken out and caught up by the wind . er very easily (3) /with that feature . incidentally . often goes . er a considerable . er length . of filament (1) longer filaments . so that the anthers (1) are not confined . within . the corolla and so forth . but are way up . er above the flower (1) /this again . is a good thing . from the point 30 of view of er the wind picking up . the pollen (3) /the anthers are up in the air and can readily be caught . by the wind (1) /another thing again . in such flowers . usually the filaments are not terribly rigid . they're rather thin . and this all helps the . er stamens to wave about and er . cause the pollen to become airborne (2) /however er this these are adaptations (1) on the part of the androecium . to the particular mode . of pollination (2) /the general run of things is is that the filaments are . er fairly rigid . and the connection to the anther . er

is also . er pretty fixed (9) /now er the er let's er forget about the filament and think of the anther because (1) as you'll have gathered from what I've said about pollen . this is the actual organ . which produces . the male . component . of the er . life-cycle . /it comes to contain the male component (5) /usually . the anthers . have four . lobes (3) /now of course in this in these drawings here I've only shown . as it were two . /but that's because of the limitations . of er a drawing . in a single plane . /we can only see two lobes from any one side (3) /but er the best way of er seeing things . is to um . look at um (2) sections . transverse sections of the anther head (2) 10 /now by transverse section I mean one . in that direction in relation to that anther . or that direction in relation to this one . here (12) /now supposing then we cut this section (9) er the view we get rather depends on the (1) stage of development . of the anther as to whether it's a young one being formed in the bud . or whether it is a mature one (2) or even a moribund one in an open flower (2) /but this is the er general shape of it (15) /the transverse section will look something like that (2) if we are dealing . with (1) a fairly young (1) anther (7) /and er if we look at this under the microscope . this young anther . in say a flower bud . then we will see . er some differentiation of 20 tissue . in the section . /we'll see first of all in each of the lobes (3) there is er a more or less central . region (3) where the cells are very different . in their shape and in their er . optical density . er from the rest . of the anther (8) /and er it is these areas here . which are going . in due course . to produce . the pollen grains . the pollen (2) /but at this er young stage there will not be any actual pollen present (1) /and what I want to do er (2) /now I don't know how er time's going but I'll at least um . make some er general remarks . I don't want to put up a detailed diagram because er we'll just have time to start and it's time to be done7 (3) /but er we find . that . these um regions 30 (1) in the four lobes are divided . into various layers . of cells (4) /and it is er . in this . central region . of each of these groups . that the actual cells which are going to produce (1) the . er pollen grains (4) er are actually formed (5) /now I think we'd better leave it at that point because we can't get any further without putting up a diagram (1) /so we continue that on Monday and on Tuesday/

## BIBLIOGRAPHY

- Allen, J.P.B. and Pit Corder, S (eds.) (1975)  
The Edinburgh Course in Applied Linguistics, Vol 2:  
Papers in Applied Linguistics.  
London: C.U.P.
- Barthes, R. (1975)  
S/Z  
London: Jonathan Cape
- Bligh, D. (1972)  
What's the Use of Lectures  
Harmondsworth: Penguin
- Bloom, B.S. (1953)  
"Thought-processes in lectures and discussions"  
Journal of General Education, Vol. 7. pp 160-169.
- Bolinger, D. (ed.) (1972)  
Intonation  
Harmondsworth: Penguin.
- Brazil, D. (1972)  
"An investigation of the relationship between intonation  
and grammar in the reading aloud of citation items".  
M.A. thesis: University of Birmingham.
- Brazil, D. (1975)  
Discourse Intonation  
Birmingham University: English Language Research monograph.
- Cohen and Nooteboom (eds) 1975  
Structure and Process in Speech Perception  
New York: Springer-Verlag
- Collier, R. and t'Hart, J. (1975)  
"The role of intonation in speech perception"  
in Cohen and Nooteboom (eds) 1975
- Costin, F. (1972)  
"Lecturing versus other methods of teaching: a review of  
research"  
British Journal of Educational Technology. Vol 3, No 1, January.



- Coulthard, R.N. and Ashby, C.K. (1973)  
 "Doctor-patient interviews".  
Working Papers in Discourse Analysis, 1.  
 University of Birmingham: mimeo.
- Chomsky (1965)  
Aspects of the Theory of Syntax  
 M.I.T. Press
- Crystal, D. (1969)  
Prosodic Systems and Intonation in English  
 Cambridge: C.U.P.
- Crystal, D. (1975)  
The English Tone of Voice  
 London: Arnold.
- Delattre, P. (1966-7)  
The General Phonetic Characteristics of Languages  
 University of California at Santa Barbara: prepublication  
 of Research Contract OEC - 4 - 7 - 061990 - 0176, with the  
 United States Office of Education: pp 81-102 reprinted in  
 Bolinger, D. (ed), (1972) as "The distinctive function of  
 intonation".
- Dubin, R. and Taveggia, T.C. (1968)  
 "The teaching-learning paradox" Centre for the Advanced  
 Study of Educational Administration Monograph No.18,  
 University of Oregon.
- Frye, N. (1969)  
 Anatomy of Criticism  
 New York: Atheneum
- Garfinkel and Sacks (1969)  
 "On formal structures of practical actions" in McKenney  
 and Tiryakian (eds.) (1969) Theoretical Sociology:  
Perspectives and Developments  
 New York: Appleton
- Gregory, I.D. (1975)  
 "A new look at the lecture method"  
British Journal of Educational Technology Vol 55, No.6.

Cutwinski, E. (1976)

Cohesion in Literary Texts: A Study of Some Grammatical and  
Lexical Features of English Discourse

The Hague: Mouton

The Hale Report (1964)

See University Grants Committee

Halliday, M.A.K. (1961)

'Categories of the Theory of Grammar'

WORD, Vol 17, 1961, pp 241-293

Halliday, M.A.K. (1967)

Intonation and Grammar in British English

The Hague: Mouton

Halliday, M.A.K. and Hasan, R. (1976)

Cohesion in English

London: Longmans

Harris, Z.S. (1952)

"Discourse analysis"

Language, Vol 28, pp 18-23

Hendricks, W.O. (1967)

"On the notion 'beyond the sentence' "

Linguistics, Vol 37, Dec.

Jefferson, G. (1972)

"Side sequences". In Sudnow, D. (ed.) (1972)

Studies in Social Interaction

New York: The Free Press

Johnston, J.O. and Calhoun, T.A.P. (1969)

"The serial position effect in lecture material"

Journal of Educational Research

Vol 62, No.6, pp 225-3

Jones, K. (1973)

"The role of discourse analysis in devising undergraduate  
reading programmes in EST (English for science and  
technology)" British Council Mimeo (ETIC)

Joos, M. (1962)

The Five Clocks

New York: Harbinger Books.

Labov, W. (1972)

"Rules for ritual insults".

In Sudnow, J. (ed.) (1972)

Lewin, K. (1943)

"Forces behind food habits and methods of change"

Bulletin of the National Research Council, No.108,  
pp 36-65

Levi-Strauss, C. (1967)

The Scope of Anthropology

London: Jonathan Cape.

Lloyd, D.H. (1968)

"A concept of improvement of learning response in the  
taught lesson"

Visual Education, October, pp 23-5

Lumsdaine, A.A. (1967)

"Improving the quality and relevance of research on  
teaching". In C.B.T. Lee (ed) Improving College  
Teaching: Washington, D.C.: American Council on  
Education; pp 240-243

Lyons, J. (1968)

Introduction to Theoretical Linguistics Cambridge:  
University Press.

Marks, L.E. and Miller, G.A. (1964)

"The role of Semantic and Syntactic constraints in the  
memorisation of English sentences."

Journal of Verbal Learning and Verbal Behaviour  
Vol 3, pp 1-5

McKenny and Tiryakian (eds.) (1969)

Theoretical Sociology: Perspectives and Developments  
New York: Appleton.

McLeish, J. (1966)

The lecture method.

Cambridge Monographs on Teaching Methods. No.1.

McLeish, J. (1966)

"Student retention of lecture material: a methodological study"

Cambridge Institute of Education Bulletin

Vol 3, No.3, pp 2-11

Mountford, A. (1975)

"Discourse analysis and the simplification of reading materials for English for Special purposes"

Unpublished M. Litt thesis, University of Edinburgh.

Falek, B. (1968)

Cross-reference: A Study from Hyper-Syntax

Prague: University Karlova Monograph.

Pearce, R. (1973)

"The television discussion programme"

Working Papers in Discourse Analysis No.3

University of Birmingham: mimeo.

Propp, V. (1968)

Morphology of the Folktale

Austin: University of Texas Press.

Quirk, R. et al. (1972)

A Grammar of Contemporary English

London: Longmans.

Quirk, R. (1954)

The Concessive Relation in Old English Poetry

Yale University Press

Rees, M. and Urquhart, A.H. (1976)

"Intonation as a guide to reader's structuring of prose texts"

University of Edinburgh: mimeo.

Saunders, N. et al. (1968)

Report on the Commission on Teaching in Higher Education

National Union of Students

Schegloff, E.A. (1972)

"Notes on a conversational practice: formulating place".  
In Sudnow, D. (ed.) (1972) pp 75-120

Schegloff, E.A. and Sacks, H. (1973)

"Opening up closings"  
Semiotica Vol 8, No.4, pp 289-327

Simpson, R.H. (1965)

"The use of self-evaluation procedures in lectures in  
education and psychology"  
Educational Review, Vol 18, No.1. pp 25-33.

Sinclair, J. McH. (1966)

"Indescribable English"  
Inaugural lecture, University of Birmingham.

Sinclair, J. McH. (1972)

A Course in Spoken English: Grammar  
London: C.U.P.

Sinclair, J. McH. (1973)

"Linguistics in Colleges of Education"  
Dudley Journal of Education  
Vol 1, No.3, pp 17-25

Sinclair, J. McH. and Coulthard, R.M. (1975)

Towards an Analysis of Discourse  
London: C.U.P.

Sinclair, J. McH. (1975)

"Discourse in relation to language Structure and Semiotics"  
Paper prepared for Burg Wartenstein symposium, Noble.

Straker Cook, R.H. (1975)

"A communicative approach to the analysis of extended  
monologue discourse and its relevance to the development  
of teaching materials for English for special purposes."  
Unpublished M.Litt. thesis, University of Edinburgh.

Stubbs, M. (forthcoming)

"The discourse structure of informal committee talk."

- Sudnow, D. (ed.) (1972)  
Studies in Social Interaction  
 New York: The Free Press.
- Trenaman, J. (1951)  
 "The length of a talk"  
 Unpublished paper, BBC research unit.
- Trenaman, J. (1967)  
Communication and Comprehension  
 London: Longmans.
- Turner, R. (ed) (1974)  
Ethnomethodology  
 Harmondsworth: Penguin.
- University Grants Committee (1964)  
Report of the Committee on University Teaching Methods  
 H.M.S.O.
- Volosinov, V.N. (1973)  
Marxism and the Philosophy of Language  
 New York: Seminar Press  
 (originally published Leningrad 1930).
- Widdowson, H.G. and Cripser, C. (1975)  
 "Sociolinguistics and language teaching",  
 In Allan and Pit Corder (eds.) (1975)
- Wijasuriya, B.S. (1971)  
 "The occurrence of discourse markers and inter-sentence connectives in University lectures and their place in the testing and teaching of listening - comprehension. University of Manchester: unpublished M.Ed. thesis.
- Winter, E.O. (1978) (ms.)  
 "A clause-relational approach to English texts: a study of some predictive lexical items in written discourse."  
 (forthcoming in Instructional Science).

Winter, H.O. (1977)

"A clause-relational approach to English texts: a study  
of some predictive lexical items in written discourse."

Instructional Science Vol 6, No 1. Jan. 1977.